THE MODEL ENGINEER

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EVERY THURSDAY

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THE MODEL ENGINEER

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Our Cover Picture

This model, which was exhibited at the Northern Model Engineers' Exhibition, at Manchester, some months ago, is not based on any particular ship, but is the builder's idea of what a modern luxury liner should be. It is a working model, and accordingly some of the details are simplified. The hull form is somewhat angular in places, but on the water the model should be very impressive, with its length of 7 ft., the modern layout of its superstructure, and its attractive colour scheme. As an indication of its appearance and finish, we may mention that it was awarded the first prize in the section for Working Steam or Power Boats at the above-mentioned exhibition. The builder is Mr. W. E. Barnes, of Wilmslow, who is to be congratulated on his model and on his success in the exhibition.

SMOKE RINGS

To Club Secretaries

WE KNOW that the honorary secretary of a model engineering club is usually the one individual on whom rests the responsibility of seeing that the activities of his club run smoothly and to schedule. This means that he has to devote a lot of spare time to an honorary job for which he is apt to receive "more kicks than ha'pence" from his fellow-members; in this we are only too ready to sympathise with him and to be reluctant to suggest that further hardships be laid upon his shoulders !

But we feel that we must ask the indulgence of secretaries and club "Press Relations Officers" to give more attention to a small matter that gives us considerable trouble. Our feature headed "With the Clubs" is available, free of charge, to any club or society devoted to our hobby or kindred interests; but we appeal, once more, to all concerned to note a few simple instructions. All copy intended for publication in "With the Clubs" should reach us not later first post on the Thursday fortnight before publication, and it should always bear the name and address of the hon. secretary. Announcements should be as brief as possible. Any issue of THE MODEL ENGINEER shows the kind of notes we require; but many of these have had editorial time spent on them to put them into the required form.

On the other hand, we are grateful to those who send in notes exactly conforming to our simple regulations.

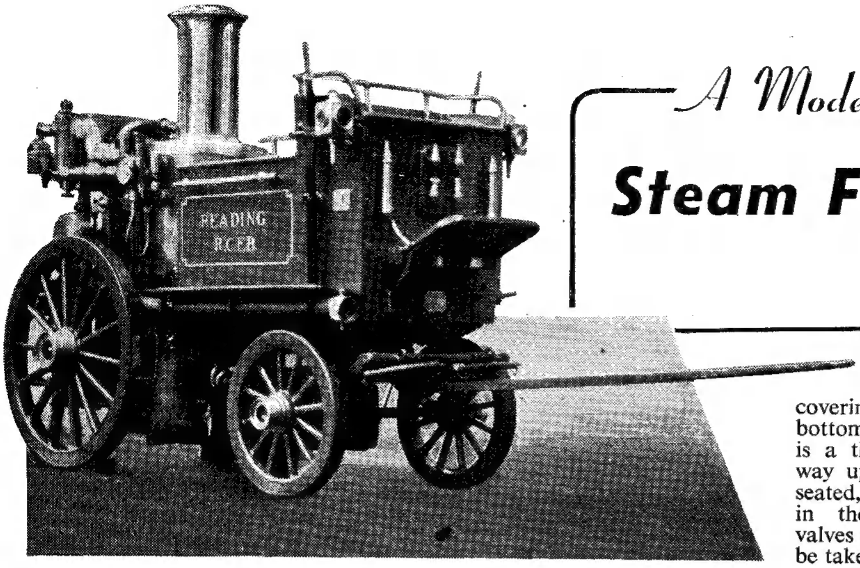
The Railways' Future

READERS ARE beginning to write to us asking if we can give information as to what is going to happen on the railways of Britain, now that the Railway Executive no longer exists; will they be split up into separate companies like those which existed before 1948 ? Will there be a revival of variety in the styles of painting for locomotives and rolling-stock ? Are only twelve types of locomotives to remain all that are necessary for operating the traffic all over Britain. These and other questions seem to be exercising the minds of railway enthusiasts everywhere.

We can only say that, so far as we know, the answers to these questions cannot yet be given. The British railways now belong to the British Transport Commission, which body will administer them on behalf of the Government; but the details of the final scheme are not yet known. The only change that has been made, so far, is that each region is now under a General Manager who, under the Railway Executive, was Chief Regional Officer. It may be the intention to give the individual regions a certain degree of independence so far as their administration and operation are concerned; but whether this will extend to the designs and liveries of locomotives and rolling-stock remains to be seen. To many people, this would give much satisfaction, but would it be in the best interests of the railways as a whole ?

Road Locomotive Photographs

IN OUR issue of September 3rd, Mr. W. J. Hughes mentioned some sets of official photographs of road locomotives, made by John Fowler & Co. (Leeds) Ltd. Mr. A. Pepper, chairman of the Fowler Veteran's Association, states that the demand has been so great that he has had to have further batches printed of the first two sets. He also states that a third set is now in the hands of the printers and, like the other two, consists of four postcard-size prints; the subjects of this third set are: A B6 Compound Showman's Road locomotive; an R3 Compound Showman's Engine; a 3-cylinder Military Steam Road Tractor, and a Class BB Compound Steam Ploughing Engine, as used in England. Each set of four cards is available at 4s. per set, from Mr. A. Pepper, Fowler Veteran's Association, Fowler Works, Leeds, 10.



A Model Steam Fire Engine

By R. Fenwick

ABOUT two and a half years ago, I came across a set of castings for a twin-cylinder vertical steam engine. Just then, the Fire Brigade, of which I am a member, unearthed an old Merryweather steam fire engine to take part in the annual display. After having a look at the old steamer, I decided it would be just the type of thing to make a model of, incorporating the castings. As I had never used castings before or, for that matter, never made a working steam model, I did not want to start something I could not finish; still, the works looked fairly simple. However, before I could get all the dimensions of the original appliance, the annual display had come and gone; and so had the steamer, back to its owner some distance away. Still, I had managed to get some of the dimensions and also two small photographs, so a start was made. As I am not experienced in model engineering or live steam work, I wanted to make a working model that resembled a steam fire engine without costing much and yet be coal-fired and simply made.

The size of the model was decided by the size of the castings, these were machined up without much bother, following instructions for holding to faceplate, etc., from "L.B.S.C." notes. A piece of steel-plate $\frac{1}{8}$ in. thick was obtained and the cylinders were then bolted by their bottom covers to this plate. Next, a brass bar $\frac{5}{8}$ in. thick was cut in half with a hacksaw and provided enough metal to make three standards the shape of an "H," $\frac{1}{4}$ in. thick. These standards serve to connect up the steam side with the water side. The cylinders, *via* the steel plate, are bolted to one end of the standards and the water pump top cylinder covers to the other end. In the middle of the standards, one on each, is a plain bearing for the crankshaft which was turned from a casting. The crankshaft was machined up fairly easily, once again with an "M.E." by my side.

Each piston rod terminates in a cross beam at right-angles to the crankshaft, the beams being made from brass left over from making the standards. These beams straddle the cranks, and at their ends a steel rod is screwed which terminates in another beam connected to the water pump piston. Bolted to the two outside standards are two brackets forming the support for the whole pumping unit on the chassis. When the two valve eccentrics were made a great thrill was experienced from the fact that by blowing into the steam inlet on the steam-chest and moving the valve spindle, the piston rod could be made to move up and down. Flywheels were made from a chunk of cast-iron bar suitably turned to shape.

The water pump unit was made next, and as the full-size pump consisted of many mushroom-valves fitting into complicated waterways and enclosed in a compact casing, this would, to me, have been very hard to make; so I decided to copy the stirrup-pump design. I obtained some scrap brass bushes that had once belonged to some inner part of a fire escape long since gone on the scrap heap. These bushes were about 2 in. long and $1\frac{1}{4}$ in. in diameter. I turned, drilled and bored two of them out for cylinders, and four more bushes were made into the top and bottom covers. The valves consist of a suction-valve which is in the shape of a mushroom covering a ring of small holes in the bottom covers. The delivery valve is a thin disc sliding for a short way up the piston-rods and, when seated, covers a ring of small holes in the piston. The mushroom-valves are of brass, and care had to be taken in turning them as they are very thin and had to be kept dead smooth on their seating side. From the top of the cylinders a pipe from each one leads into the delivery chamber situated in front of the cylinders, this chamber was made from a block of brass and was hollowed out by drilling and chiselling. The cover plate for this contains the two delivery outlets, these outlets are controlled by a valve made from a brass disc with three holes drilled through it and fitting flush against the inner side of the cover. The holes in the disc are so arranged that, when the disc is rotated by the valve-handle, either one or the other or both the deliveries come into operation. The valve is made water-tight by the pressure of water against it. Take offs for the pressure gauge, boiler feed and drain come from the delivery chamber. An air vessel is screwed into the top of the chamber, this vessel was made from brass bar, bored out and a small cock fitted to the bottom of it; this cock came from a full-size steamer. The bottom covers of the pump are connected by short lengths of tube to a main suction inlet at the side of the cylinders, which is another piece of brass cut to shape by sawing and filing.

When the steam and water mechanism had been completed, a start was made on the chassis. An old brass windscreen frame was obtained, dismantled and the metal cut to beam shape. The chassis is bolted together, the joints being made up of steel angle-plates. The wheels were made next; the hubs were made first, then four wooden rings, which were drilled through at the position the spokes were to be, then hubs and rings were pinned to a plan drawn on a piece of card; the

spokes were dowels pushed through the rings to fit in sockets in the hubs, and were then glued into position. A piece of packing case steel strip was fitted to form tyres. This method, of course, is not the correct way to make such wheels, but is simple.

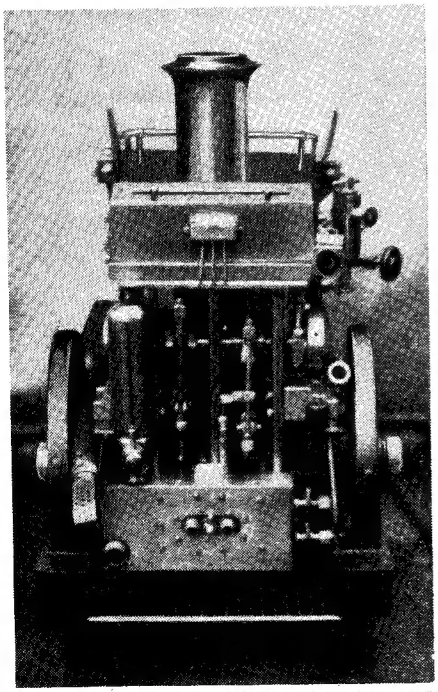
Springs were made from clock-springs; they are dummy, the weight being taken by extending the shock-obsorber over the axle up to the under side of the chassis. The hose-box, seat and running boards were from plywood, handrails from brass rod, lamps and nozzles from odd scraps of brass such as terminals. The water-tanks on the rear platform are solid blocks of wood covered with cardboard punched with a centre-punch to form dummy rivets.

The boiler was made next. These boilers have a coned fire-box, and to reproduce the shape proved quite a problem in sheet metalwork. A piece of copper tube and some sheet were obtained and a friend made the boiler up; it is riveted and silver-soldered and has six $\frac{3}{8}$-in. tubes and a centre flue of $1\frac{1}{8}$ in. diameter. The boiler is lagged with asbestos sheet covered by thin brass sheet.

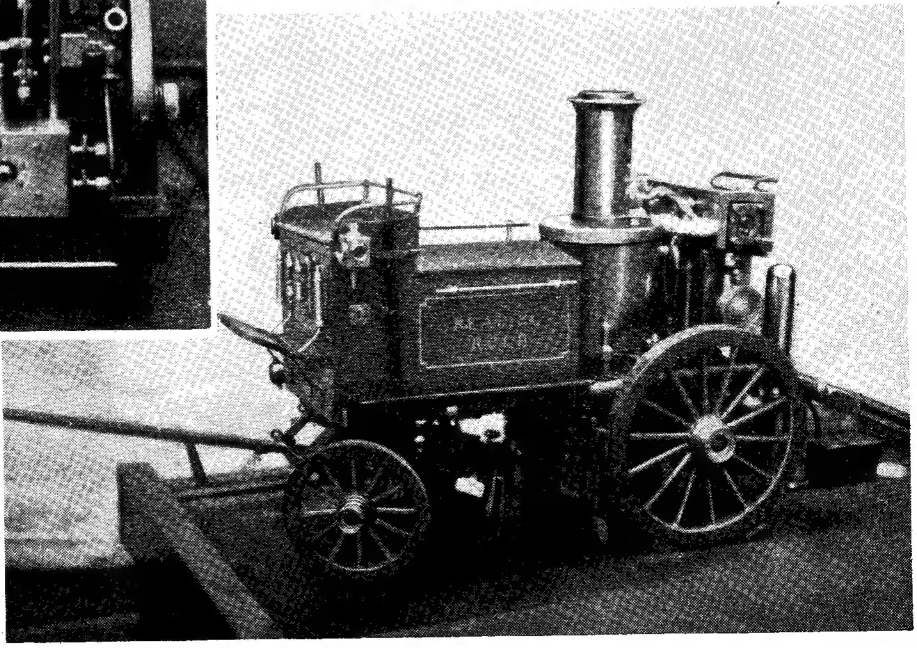
The chimney on a steam fire engine is, to my mind, the most distinquished feature, so great care was taken to ensure that this one would look right. A piece of sink waste-pipe was obtained and after the chrome finish was rubbed off the end was belled out with an assortment of things from a door knob to a small empty oxygen cylinder. The liner was made from the two halves of a suction wind-screen wiper silver-soldered together, the space at the top of the liner and the casing being covered in by a thin brass ring. The whole of the chimney was silver-soldered by me with an oxyacetylene cutting set, the smokebox top was turned up from a casting, a pattern being made on my home-made wood turning lathe. Blower valve, clack valves, whistle and other steam fittings were made from scraps of brass. The suction hose was made by inserting lengths of bronze spring into rubber tube, the couplings being adapted gas fittings. The model was painted with two coats of red gloss paint, and flat black paint on the chassis and under-neath parts. Lining was done by painting toilet-paper with gold paint, cutting into strips and sticking to the model, the letters are transfers. At first all the brass work was coated with nail-varnish, to prevent tarnish; but after the first trial run the varnish on some of the steam fittings turned brown with the heat, so the varnish was removed.

The model is mounted on an imitation road when it is to be steamed, the road being a piece of sheet-iron very slightly curved to form the lid of a box in which are two tanks containing water for pumping, and for the boiler supply which can be pumped into the boiler by a hand-pump fitted in one of the tanks, its handle protruding up through the side of the "road." The feed pipe passes from pump to boiler clack through the centre of the "road." Coal and oil are stored in a bunker built into the side of the box in between the two water tanks. A hole cut in the centre of the "road" allows the suction hose to be dropped through into the water tank; waste water is drained off from the "gutters" each side and led into another tank in the box.

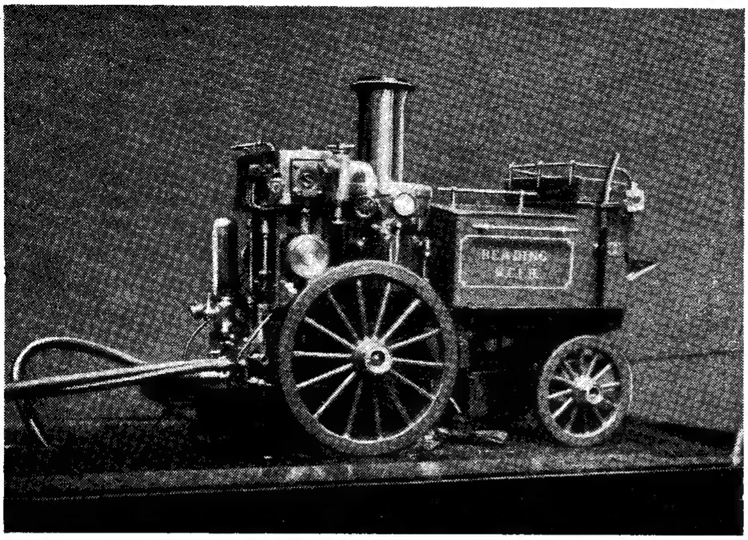
This being my first attempt at a steam model, I found some difficulty in firing and running it and, at first, often nearly forgot to see to the requirements of the boiler in the excitement of seeing the model



Rear view, showing set-up of engine



Right: Near side view, showing compactness of engine and boiler



About to start pumping with 30 *lb. steam pressure on the gauge*

pumping two miniature fire-fighting jets of water; also, the fire requires plenty of looking after, for it soon burns away. Anthracite mixed with steam coal is the fuel used.

One rather amusing incident happened once; I was preparing for a run and had filled the firebox up with wood soaked in parraffin and left it for a few moments, then lit up; at once, a flash-back occurred setting fire to the paint on the back of the hose-box. Unfortunately, there was no steam up for the pump to be got to work, and a jet of water played on the fire; still the fire was soon extinguished. It was found afterwards that the boiler flue was sooted up and choked so that the paraffin vapour could not get away.

As stated at first, I had no real drawings or dimensions to go by, so the model was built by making a part, fitting it to the rest of the model and if it seemed to be right it stayed on; if not it was altered and made to look right.

The main dimensions of the model are length 1 ft. 5 in., height 12 in., width 8 in. Cylinders $\frac{3}{4}$ in. stroke, $\frac{3}{4}$ in. bore. A two-element superheater. Working pressure 40 lb. per sq. in. The boiler was tested to 110 lb. per sq. in. by the hand pump. A good deal of pleasure was got from making the model; also, a lot of knowledge was gained, and mistakes and faults made in this model will not be made in the next one which will be, with the help of THE MODEL ENGINEER, a steam locomotive.

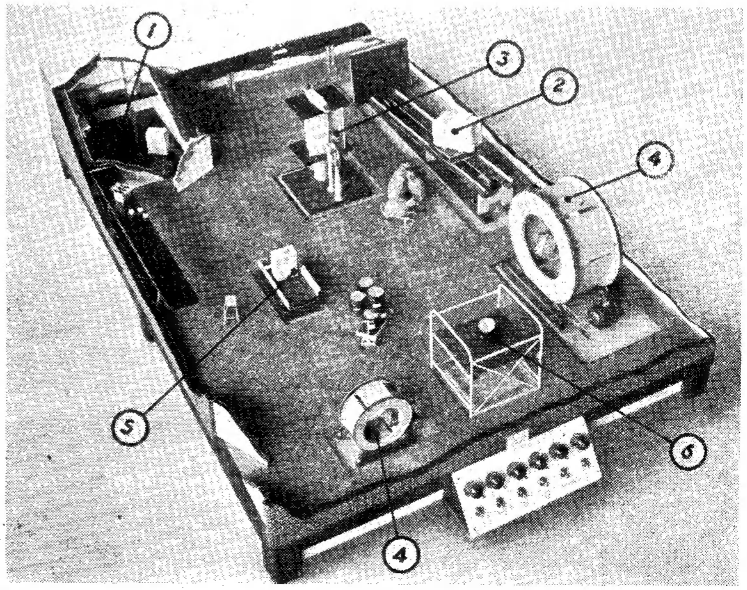
A MODEL PACKAGE-TESTING LABORATORY

AT one of the National Packaging Exhibitions held at Olympia, an interesting working model of a package-testing laboratory was among the exhibits on view. This model, which was 1/12th full size, comprised a base to represent a room 50 ft. × 36 ft., which had various working scale models on it. The models were powered by 1/100 h.p. 24 V, d.c. 3,000 r.p.m. electric motors, the speeds being reduced through suitable worm reducers.

In one corner was a sectionalised humidity room showing its inner construction (No. 1 on the photograph). The purpose of this room is to enable tropical tests to be carried out on packages, etc. No. 2 on the photograph shows an inclined plane test, used for reproducing the type of shock as experienced by packages, etc., during the shunting of railway trucks. No. 3 shows a compression test which is used to obtain a measure of possible stacking heights of packages. No. 4 shows a large and small rotating drum test, used for mild rough-usage tests. No. 5 is a vibrating table used for reproducing vibrations as experienced during road and rail transport. No. 6 shows a drop test for estimating the effect of dropping packages in a particular manner.

On the model were replicas of packing cases, oil drums, sacks, etc., and visitors were able to operate the model via a switchboard. Thanks are due to the Director of Research, Printing, Packaging & Allied Trades Research Association, for permission to print this account.

—G.H. ESSEX.



IN THE WORKSHOP

BY DUPLEX

SAWING GUIDES FOR THE JIG-SAW

ALTHOUGH the work guides or fences referred to in this article were made for use with the jig-saw machine recently described in these pages, these accessories will be found suitable for fitting to other machines of this kind, as long as the table itself has been accurately made and its edges are machined square.

It will, at once, be realised that a wide range of useful work can be done, and valuable time saved, with the aid of these fences; for example, the parts of a mitred, wooden frame can be machined to the finished size and then assembled without the need of any hand work. Sheet metal and plastic materials can also be cut up into parts of uniform length and width. In addition, circular discs and holes can be cut out to an exact diameter by means of a simple circle-cutting attachment.

The various types of materials: metal, wood, and plastics, of course, need saw blades of different kinds; but, as previously mentioned, the "Eclipse" range of blades covers all these requirements. The saw blade is most easily changed by turning the machine on to its side, so that the driving gear lies upper-

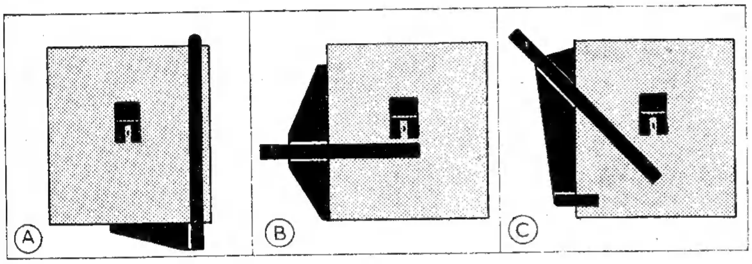
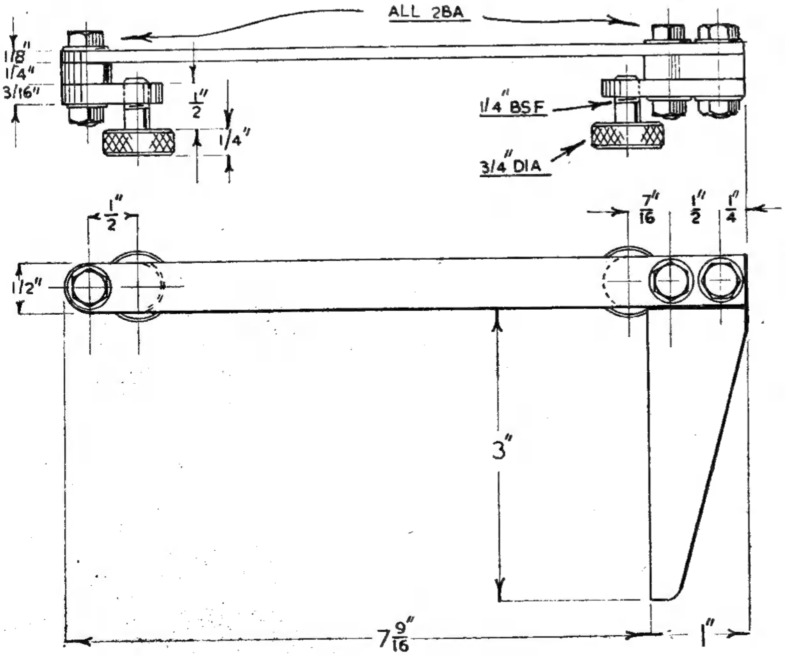
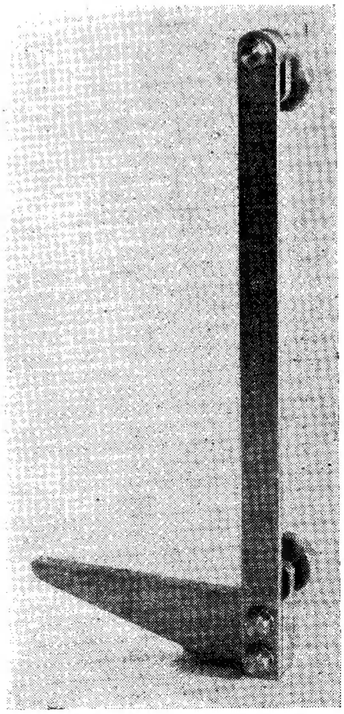


Fig. 1 (*left*). *Showing the positions on the machine table of* (*A*) *the width-cutting fence,* (*B*) *the cross-cutting fence, and* (*C*) *the mitring fence*

Fig. 3 (*left below*). *Dimensions of the width-cutting fence*

Fig. 2 (*below*). *The width-cutting fence for parallel sawing*





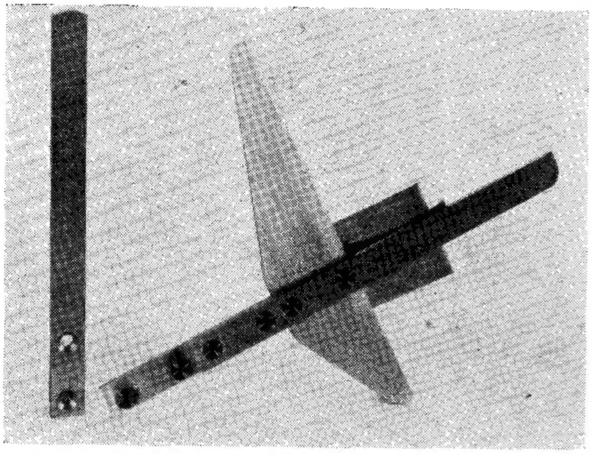


Fig. 4. *The cross-cutting fence and extension-piece*

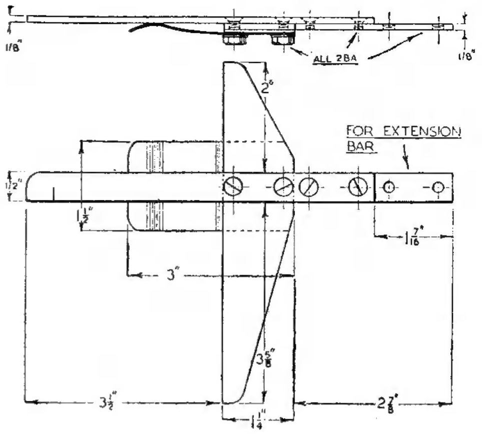


Fig. 5. *Dimensions of the cross-cutting fence*

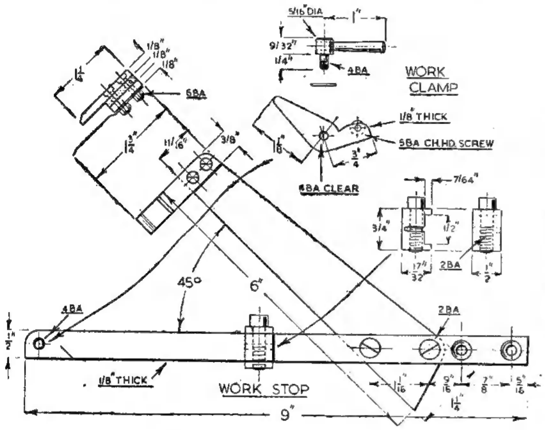


Fig. 7. *The mitring fence with its work stop and work clamp*

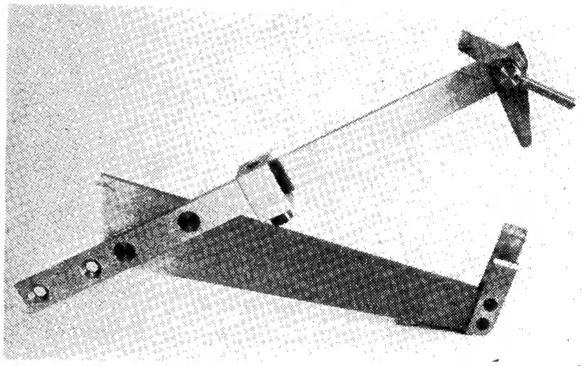


Fig. 6. *The mitring fence*

most, and the table does not then obscure the view of the lower anchorage of the saw blade.

The Width-cutting Fence—Fig. 2.

This fence enables strips of material to be cut to a uniform width. The stock, or head portion, abuts against the right-hand edge of the table and the blade for guiding the work lies on the surface of the table.

After the required width of cut has been set, a clamp-screw at either end of the blade serves to secure the fence to the table and, at the same time, the stock maintains the blade parallel with the line of the saw blade. The construction of the fence is quite straightforward, but the guiding surfaces of the blade and stock must be filed true. It is advisable to allow a small amount of clearance in the bolt holes, in order to enable the two limbs to be set exactly at right-angles to one another after assembly, and then securely bolted together.

When using the fence, the abutment edge of the work must first be made straight and square to serve as a guide face. A number of parallel strips of any required width can then be cut off, and it will be found that the edges are left square and cleanly cut; in fact, when cutting wood in this way there is no need to plane the sawn edges, for a good finish can be obtained merely by light sand-papering. Where the cut surfaces have afterwards to be glued together, they are best left as they come from the saw, as this gives a keying effect in the joint.

The Cross-cutting Fence—Fig. 4.

With this fence the material can be cut into pieces of any required length.

The stock bears against the front edge of the table and is slid away from the operator, standing at the right of the machine, when cutting through the work-piece. As a guide for positioning the work, a line is engraved on the blade to correspond with the line of the saw teeth. To help in keeping the stock in place against the edge of the table, a piece of shim-steel, 10-thou. in. or so in thickness, is fastened to the under side of the stock, with a distance-piece between the two parts. Again, after assembly, the blade is set exactly square with the stock and then securely bolted in place. To enable a long length of material to be cut off, the extension-piece shown in Fig. 4 can be attached to the outlying end of the blade. For cutting a number of parts to uniform length, the adjustable stop, Fig. 6, is clamped with an Allen screw in any position along the length of the blade or its extension-piece.

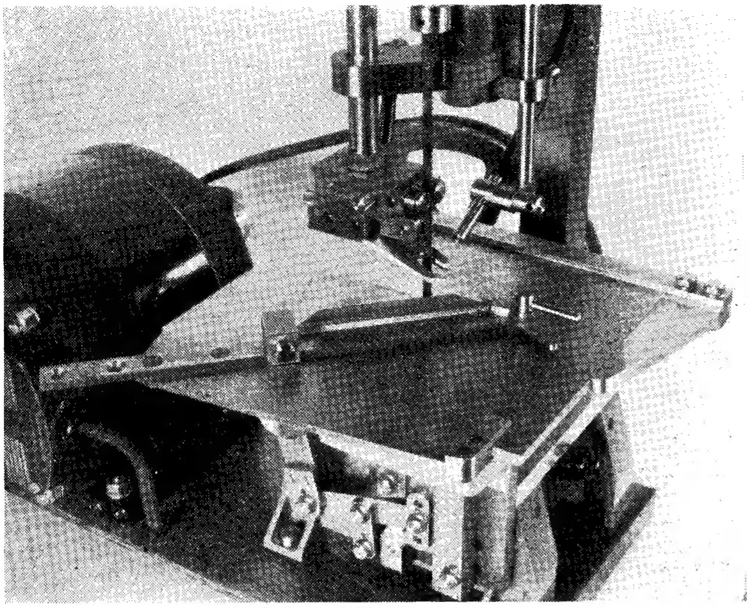


Fig. 8. Showing the width-cutting and mitring fences in place on the machine table

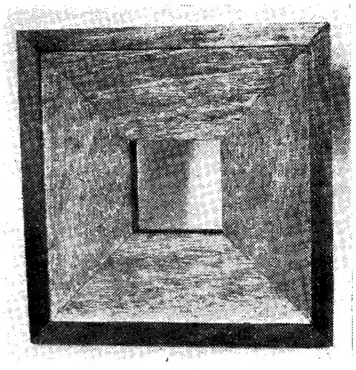


Fig. 9. A 6 in., mitred frame machined in the jig-saw

The Mitring Fence—Fig. 6.

This attachment enables material to be cut exactly to an angle of 45 deg., and this has proved most useful when making components for cameras and photographic enlargers. Making picture frames from commercial moulding is also an easy matter, and no hand work is needed.

The stock of the attachment slides against the front edge of the machine table and, at the trailing end, a guide-piece and a leaf-spring are fitted to keep the fence in position. During cutting, the stock is, as before, moved away from the operator.

The blade is furnished with screw holes for attaching the extension-piece, previously described, and the same adjustable stop is also used. In addition, a pivoted lever-clamp is fitted for locating the work and preventing it sliding along the oblique edge of the blade under the pressure of the cut.

When adjusting the position of the blade on the stock, set the two parts with a protractor to 45 deg.; then mitre two strips of material and fit them together; finally, check the joint with an accurate protractor. In this way, any departure from the 45 deg. angle will be doubled and, after making any necessary correction, the two limbs of the fence are firmly bolted together.

An index line can now be engraved on the blade to indicate the line of the saw teeth.

Making a Small Frame in the Jig-saw

The parts of the 6 in. square, mahogany frame illustrated in Fig. 9 were cut to the finished size in the machine in the following manner.

The "Eclipse" blade used for this work is designated 28C10P; indicating that it is 28-thou. in. in thickness, $\frac{3}{16}$ in. in width, has ten teeth to the inch, and is furnished with driving pins at the two ends. These blades leave a smooth finish on the work, as the teeth are accurately milled to shape and then given a uniform set. As the blades are also hardened and tempered, the teeth

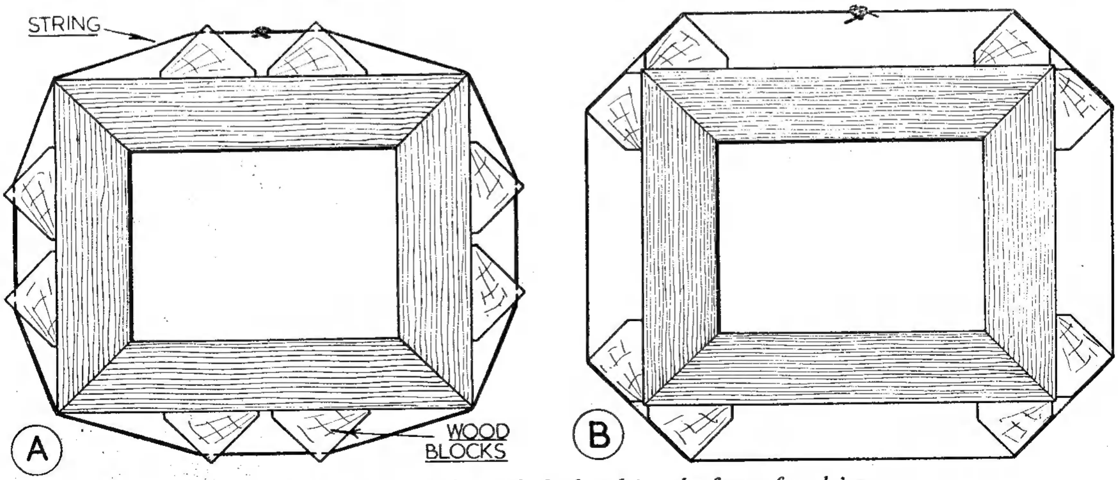


Fig. 10. Showing the method of wedging the frame for gluing

are not damaged by coming into contact with the steel fences.

The length of planed wood selected for the job was first planed straight and square on one edge and, after the fence had been set to cut to a width of 2⅛ in., a strip of material was cut off to this width. Next, the strip was marked-out with a protractor for cutting up into four lengths with ends at 45 deg.

By means of the mitring fence, the four pieces were cut off some ¼ in. longer than the finished length.

To cut the strips to a uniform, finished length, the adjustable stop was set 6 in. from the engraved line on the blade, and each piece was, in turn, held against the stop with the clamping lever and, in this way was cut to the exact length.

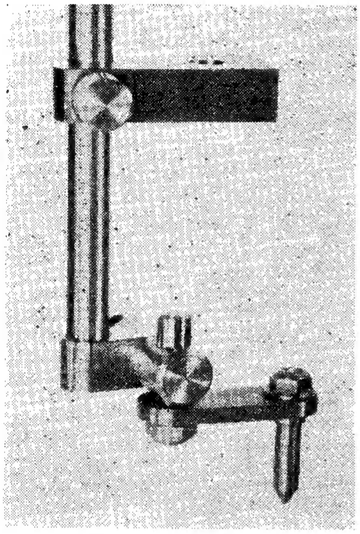


Fig. 11. The circle-cutting attachment replacing the air nozzle

The pieces forming the sides of the frame can now be assembled and held together by means of a loop of cord and a set of eight wedges, as illustrated in Fig. 10. These wedges are the off-cuts left after sawing up the material and, when moved apart within the circle of string, they serve to tighten the string and bind the frame together while the glued joints are setting.

However, before applying the glue, the frame should be examined and checked to make sure that the joints have been correctly cut, but there should be no doubt on this point if the fence has been accurately made and properly used. All being well, the joint surfaces are glued and the frame securely wedged.

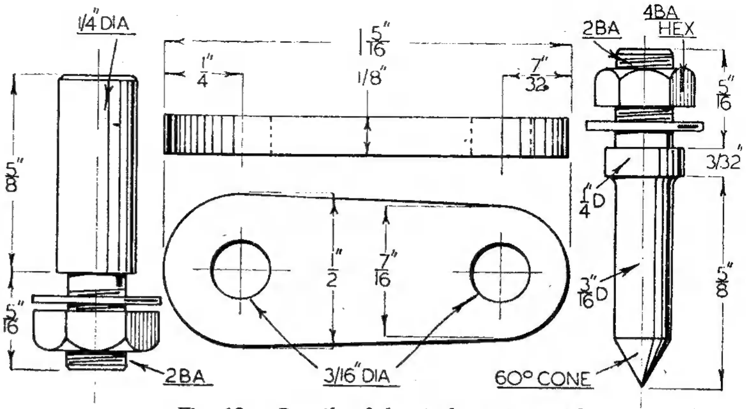


Fig. 12. Details of the circle-cutting guide

To ensure that the frame is flat, place it on the surface plate with another flat plate and a weight on top, and leave it like this until the glue has set. If thought necessary, the corners of the frame can be strengthened by inserting wood screws or glued wooden dowels, or strips can be glued into oblique saw cuts formed at the four corners.

It will be noticed that the frame illustrated has been rabbeted for attaching the camera bellows; this was actually done in the shaping machine after the parts had been mitred, but before they were glued together. The photograph of the frame was taken immediately after jointing, and before the surface had been sand-papered and polished; nevertheless, it will be seen that the corners fit well and, in this way, much tiresome work with plane and shooting block was avoided. It might also be mentioned that a 3-in., mitred frame with a 1-in. square opening was machined in the jig-saw with an equally satisfactory result.

Cutting Discs and Circular Holes

To cut out a wooden disc, the outline is first marked-out with the dividers and the centre mark is deepened with a centre punch. The circle-cutting attachment is mounted in place of the air nozzle, as illustrated in Fig. 11, and when the saw blade has been carried as far as the marked-out circumference, the coned centre is engaged in the punched centre and the work is slowly rotated with the hands. When cutting an internal hole, the work is first drilled to allow the saw blade to be passed through, and the guide centre is engaged as soon as the cut meets the circumference. A narrow saw blade is used for this work, and a 20D10P blade, 0.110 in. in width, has been employed to cut circles of 1 in. diameter. For smaller work, narrower blades, 0.035 in. and 0.05 in. in width are standard "Eclipse" products.

Work machined in this way is left with a very smooth surface and has the appearance of having been turned in the lathe.

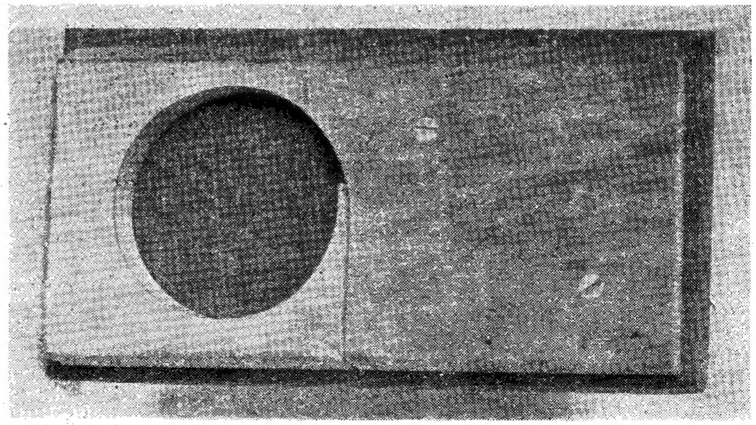
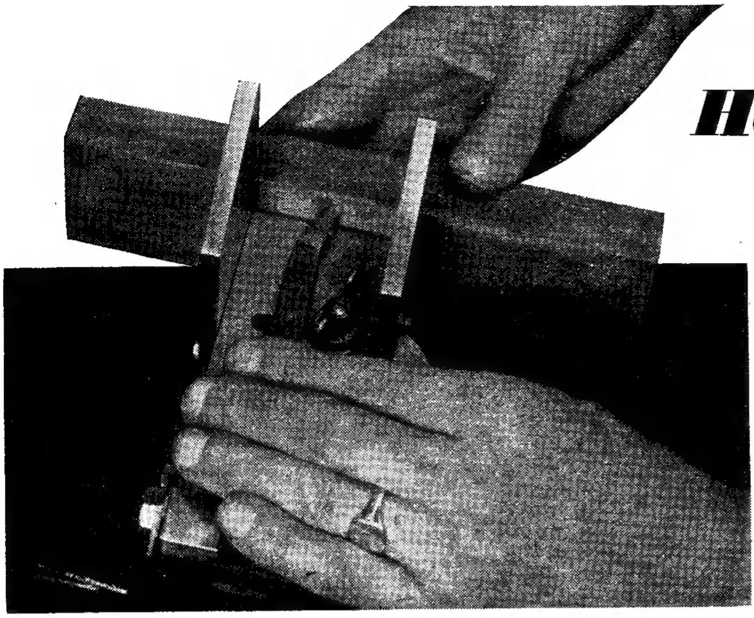


Fig. 13. Illustrating the method of cutting out a circular disc



An improved Honing Jig

By E. H. Reid

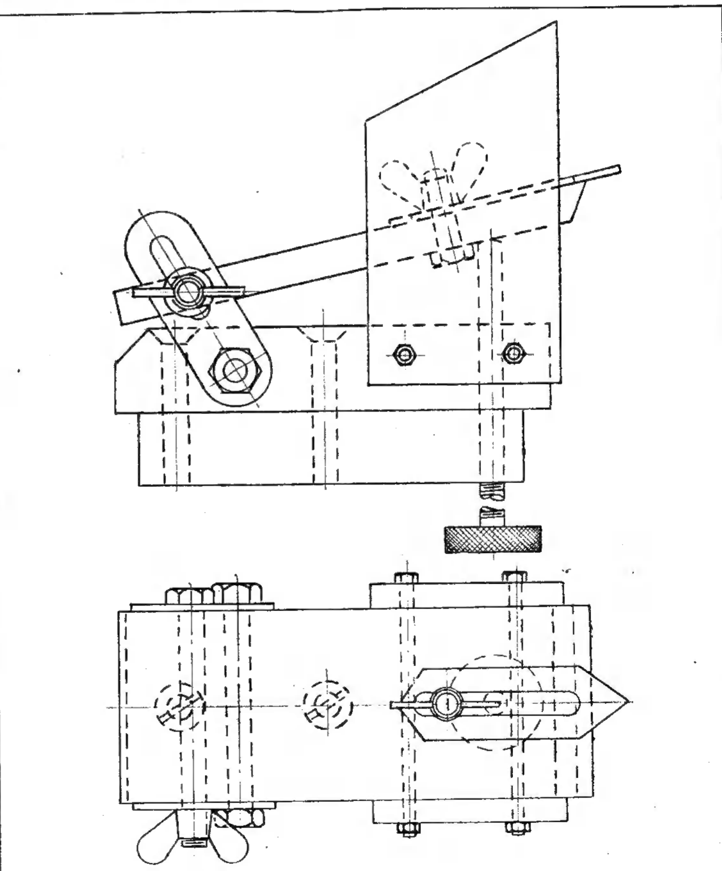
The honing jig in use, viewed from above to show a left-hand side tool presented to the hone at correct front clearance angle

IN the issue of THE MODEL ENGINEER dated September 13th, 1951, "Duplex" gave details and illustrations of a jig for honing lathe tools, to enable the correct cutting angles to be maintained. The device shown here is designed with the same object in view, and though more elaborate, and possibly more difficult to construct, has the advantage that it can be adjusted to suit different cutting angles, and for use either with solid tools or small cutter-bits.

The base of the jig is built up, having a tongue to enable it to be gripped in the bench vice, and the guides for locating the hone are attached vertically to its sides. Also attached to the base by a pivot bolt are two slotted plates, which form a fulcrum for the adjustable platform on which the tool rests. A vertical screw through the base enables the platform to be elevated to the required angle in relation to the guide plates, and it can also be retracted, by swinging the slotted links, so that its front edge does not project beyond the guide plates. To enable the side angle of the tool face to be accurately adjusted, a further refinement in the form of an angle-gauge is fitted to the platform.

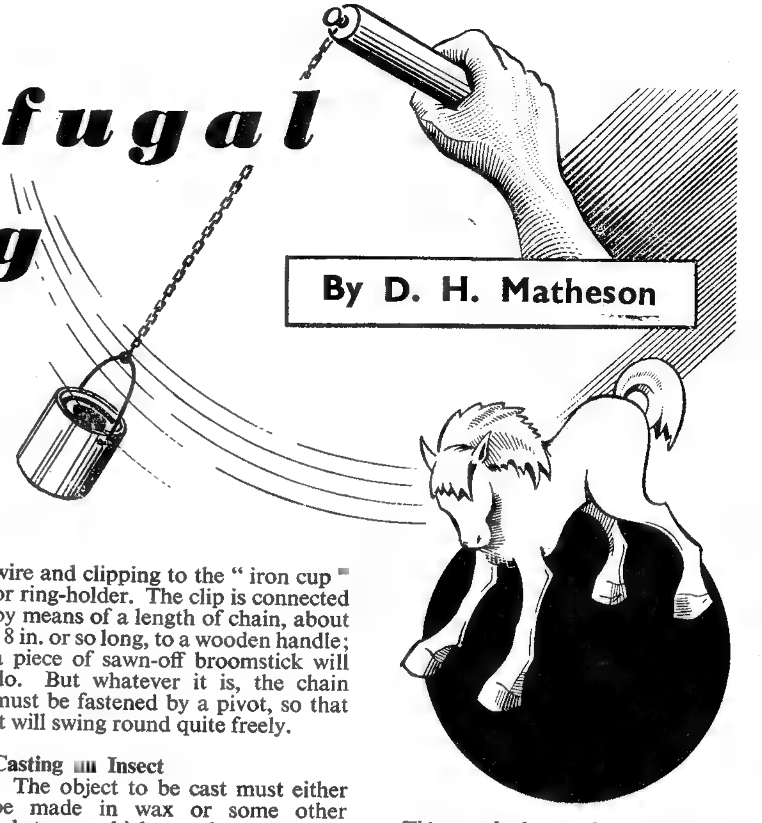
With this jig it is possible to obtain clearance angles ranging from the few degrees required for ordinary metal turning, to the larger angles usually employed in the ornamental turning of wood, ivory, plastics, etc. In this respect it serves the same purpose, within limits, as the device known as a Goniometer or Goniostat, which is usually recommended for this purpose.

Readers who require further information on this appliance should refer to Holtzapffel's *Turning and Mechanical Manipulation*, Vol. III, in which several different types are described.



Side elevation and plan of honing jig

Centrifugal Casting



By D. H. Matheson

This method can be used for casting miniature statuettes such as the one shown here

THERE is a method by which one can cast perfect miniature models of practically anything that takes ones fancy. Such things as charms, rings, tie-pins, or an insect, like a beetle or scarab, in gold, silver, copper, brass or aluminium. It is possible to cast in copper a wasp so perfectly that even the little veins in the wings are apparent. One can cast a small beetle, and afterwards solder it to a tie-pin, or cast a plain or ornamented finger-ring, also little statuettes in various metals. Any of these items may be finished by electro-plating if desired.

Materials

The tools and materials are not expensive, and are easily obtainable. You will require a foot-bellows and blowpipe, which are usually to be found in most workshops. Other useful items of equipment are a gas-ring, bunsen burner, small-bladed pocket-knife, a small fine file, No. O sandpaper, hone and a polishing-lathe, or headstock carrying a revolving buff-wheel. This latter tool is not absolutely essential, as one may produce an excellent finish by hand-polishing. Some modelling wax and special casting plaster will also be required. Any of these items may be purchased at a dental store. But when ordering, ask for special casting plaster and modelling wax; you must say you require it for casting purposes, or you may be given the wrong kind.

The casting apparatus itself consists of a piece of brass tubing about 2 in. long and 1 in. diameter (Fig. 1B), called a " ring " in workshop parlance. A larger cast, one that covers a greater area, will of course, require a wider ring. But each ring must have a fellow one, a size larger, for it to fit into easily. This outer piece of tubing is called the ring-holder, and is usually a piece of thin iron tubing (Fig. 1C), for iron may be used for the ring-holder, with a bottom fitted at one end, and two holes opposite one another, bored at the other end to take a removable clip-on connection made by bending a piece of stout iron wire and clipping to the " iron cup " or ring-holder. The clip is connected by means of a length of chain, about 18 in. or so long, to a wooden handle; a piece of sawn-off broomstick will do. But whatever it is, the chain must be fastened by a pivot, so that it will swing round quite freely.

Casting an Insect

The object to be cast must either be made in wax or some other substance which can be completely burnt out of the mould. The body of an insect may be used as a pattern. After catching an insect, kill it by nipping its head with a pair of tweezers or else employing some stupefying mixture; of course one should be careful not to damage the object. A butterfly, for instance, may be cast perfectly. Or you may model in wax an Egyptian subject such as a scarab; but whatever it is, the same method applies in all cases.

Method

If you use an insect, take a pin and cover with wax, making it the thickness of the lead of a pencil, leaving the point uncovered sufficiently to insert in the insect and cutting the pin to $\frac{1}{2}$ in. in length. But if you are using a wax pattern, a $\frac{1}{2}$ in. length of wire $\frac{1}{16}$ in. thick may be used, one end being inserted in the wax. Should a bigger model be used, then it will be necessary to have a thicker wire to feed the mould.

Next warm a lump of wax and shape it into the form of a half walnut-shell and stick to the other end. See Fig. 1A.

Now take your " ring " and prepare your plaster, by ladling with a dry spoon into a basin containing sufficient water, what you will require to fill the ring. The surplus water should be poured off, and the plaster mixed to a cream-like consistency. Never add more water or plaster after starting to stir or you will spoil the mix; and it is essential that you get your " investing material " as the plaster is called, properly mixed, or your cast will be a failure. As soon as mixed, take a small brush—one of the " quill handle " variety costing about 2d. will do admirably—and paint with care the whole of the model and connection, except the base of the wax block. Use great care not to have any bubbles, or that will mean later a blob of metal wherever the bubble was formerly; and of course, the blob will have to be removed with a file, which is a rather delicate, or at any rate tedious job. Moreover, the model may also be damaged. But having covered the whole job, except the top, with plaster, stand the model on its wax block base and put the ring over it, and then fill gradually and carefully with plaster until the top is reached (Fig. 1D).

Next leave the plaster to set. This should take about 20 min. Meanwhile, you should wash out basin, spoon and brush, as, while the plaster is soft, it is much easier to do.

When the plaster is set, take the ring and gently warm the wax block, which will readily be seen on turning the ring upside down, over the bunsen burner, and then remove. Next warm the " sprue-way " (the short passage leading to the cast) and with a fine pair of pliers pull out the wire or pin. Then place the ring on the gas-ring, with the hollow concave cavity uppermost. This cavity is to hold the molten metal before it passes down the sprue-way and into the mould. Light the gas and turn very low. This is necessary, for, if sudden heat is applied, the moisture in the plaster becomes turned to steam rapidly, and consequently, in finding no outlet, blows the whole plaster-cast to pieces; this has been known to happen more than once. It is necessary to first just warm the whole concern and dry out the plaster. This usually occupies 20 min., after which, if you look closely you will notice whether the job is steaming or not. If no more steam is rising, it signifies that the plaster is about dry, and you may turn up the gas a bit more, and leave for another 20 min.

By this time you will notice it looking black down the sprue-way; this shows that the wax is melting out and evaporating.

Gradually turn up the gas every 10 or 15 min. until the whole of the wax is smoked out. If you are using a beetle or other insect of course, there will be no outward indication that the cavity is becoming clear; but by the time you have reached the casting stage, the whole insect will have become cremated, and the cavity left by it, quite clear.

A fire-clay dome placed over the ring will help a lot in keeping the heat in and expedite the job. After about an hour, you will have the gas fairly high, and the plaster should show cherry-red down the sprue-way.

This denotes that the necessary temperature has been reached, and the model is ripe for casting.

While waiting for the model to reach this stage, you should make preparations for casting. Set the foot-bellows and connect the gas blowpipe ready to hand on the bench. As little time as possible should be wasted between taking the " ring " off the gas and applying the blowpipe; if the temperature goes down, your model will come out only half run. Place a slab of asbestos on the bench, and on this melt your copper, silver or gold, or whatever metal you are using; if the metal is in scrap form it should all be melted into the form of an ingot.

Melting the Ingot

Having prepared your ingot, and provided the ring is still cherry-red down the sprue-way, turn out the gas, and with a pair of tongs take up the ring and convey to the ring-holder, having first dropped back the handle on one side to permit entry of ring. Then take up the wooden handle in one hand (the right is best, perhaps, depending on the operator), and with the other hand, put the ingot, with the aid of a pair of tweezers, on the sprue-way (Fig. 2). Take up the blow-pipe and apply a steady flame, but not too pointed for a start, or you'll be melting the top of the ingot and perhaps the bottom won't be quite molten, consequently you will not obtain a cast. Use a " brush " flame at first, and by aid of the thumb and finger regulator on the blowpipe, you can gradually cut off the gas and increase the air so as to get a hotter flame concentrated on the metal. The better type of blow-pipe is of the grip-regulating kind; that is, as one grips the hand-lever, the flame becomes more pointed.

If you are using gold, a little borax sprinkled on the molten metal will act as a flux. But do not touch gold with an iron tool to see if melted, or you will oxidise it. Use a piece of clay-piping; a broken stem of a clay pipe will answer the purpose admirably. As soon as you are convinced that the metal is quite melted, with a quick vigorous movement swing the whole concern round about eight times, grasping the wooden handle firmly the while. This produces centrifugal force, which drives the molten metal down the sprue-way into the mould.

Breaking the Mould

After leaving your ring for about 15 or 20 min. to cool off a bit, you may immerse the whole in cold water, and the plaster again becomes soft, so that it may readily be dug away, and the cast removed and brushed with a small brush to wipe off the plaster adhering to it.

You may produce a perfect cast at your first attempt—if not, practice makes perfect. File off any rough parts with a smooth file, and then sandpaper where necessary, and hone; after which the whole should be polished on the lathe.

If you are using copper, you could get the cast silver-plated for a small fee, or even gold-plated.

(*Continued on page* 574)

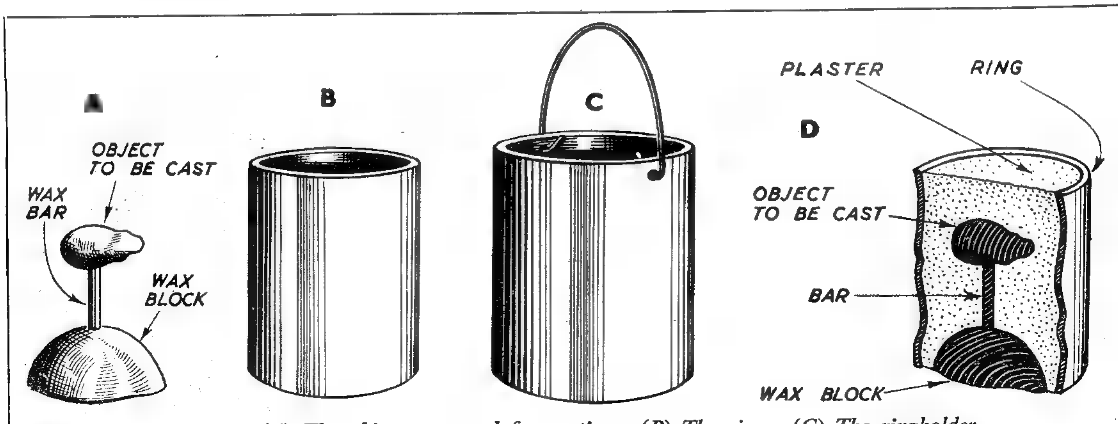
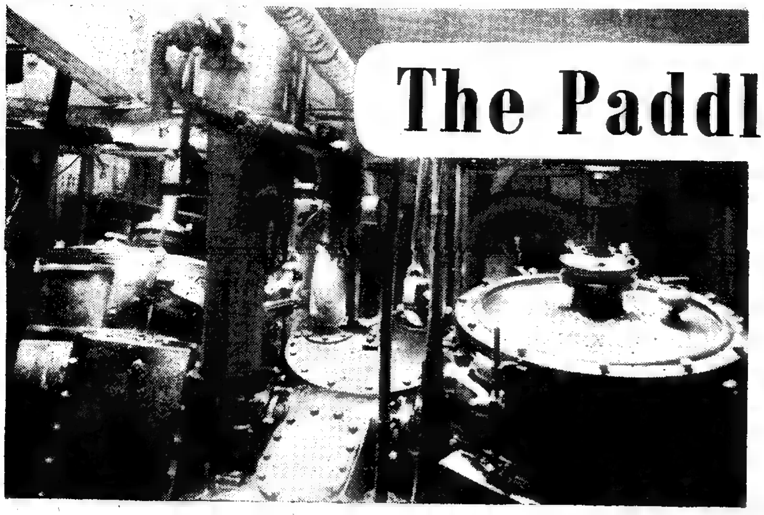


Fig. 1. (A) The object prepared for casting. (B) The ring. (C) The ringholder. (D) Cut-away view of ring filled with plaster



General view, showing the two cylinders

The Paddle Steamer "VICTORIA" retires

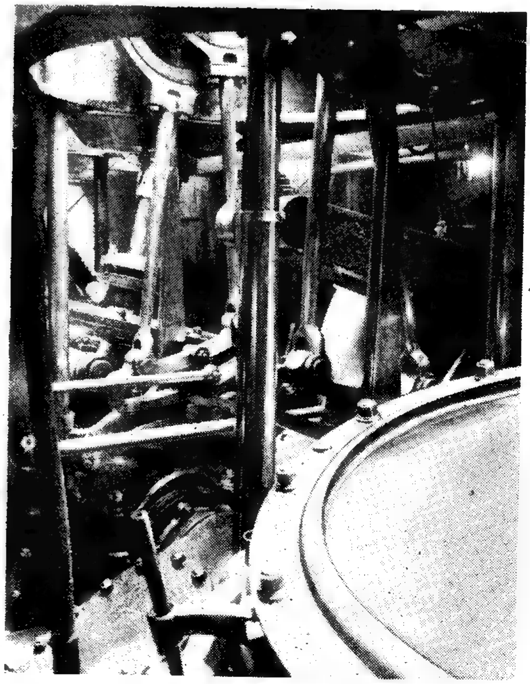
By "Student"

SHIP lovers and marine engine students alike will hear with regret that P.S. *Victoria* of Messrs. Cosens' Weymouth fleet has been broken up. One of the last two oscillating engined ships on our coast, she was 70 years old, and interesting though she was for her engines, she had a greater claim to our consideration, in that she had the last rectangular tank boiler in operation. A few notes on the ship and her unique machinery will remind us of the delightful past.

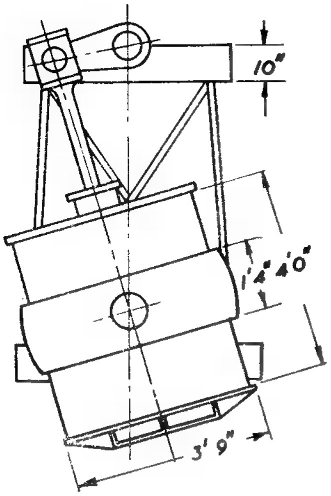
The hull was built in 1884 by J. K. Smit of Kinderdyk, Holland, being for the greater part of her life 175 ft. long. She was lengthened in 1888 when the engines were modified, her beam of 19 ft. 4 in. and depth of 8 ft. 8 in. being unaltered.

The two-cylinder simple engines were made by John Penn & Son of Greenwich, who probably supplied the first boiler, too. At their usual speed of some 28 r.p.m., their r.h.p. was 75. The bore was 35 in. and the stroke 3 ft., the working pressure being 30 lb. per sq. in. As will be seen in Fig. 1, and from the photographs, the engines were almost the standard Penn form. The headstock, carrying the crankshaft, was a massive casting some 12 ft. long and 10 in. deep, with three oval recesses, the centre one being for the air pump crank, and the outer ones for the power cranks. It was supported from the bedplate by eight forged circular stays, and had at each end a cruciform cast-iron brace, of tee-section metal bolted to lugs on the headstock and bedplate. The bedplate was in three sections, the centre one containing the original jet condenser and air pump casing. The cylinders were lagged with mahogany, latterly obscured by oil. Two valve-chests were fitted to each cylinder, one fore and one aft of the trunnions for balance; the steam being fed from the outer trunnions to the valve-chests by a belt trunk, 1 ft. 4 in. deep, around the barrel, the exhaust travelling to the centre trunnion by a continuation of it. The front valve-chests, trunk and centre trunnions can be seen in the photograph, also the original jet condenser. This was the chamber below the oval bolted cover in centre, the injection valve having been just in front of the cover. The original air pump was where the large circular cover is just behind the centre trunnions, the entire engine thus lying between the bedplate. The air pump was inclined to line up with the centre crank which drove it. Oscillating cylinders were usually fitted with deep stuffing boxes and neck bushes (in this case over 10 in. deep) which reduced the wear due to the oscillating movement of the cylinder.

The usual sector and rocker-arm valve motion was driven by link motion. This can be seen in the photograph looking along the engine, which shows the port cylinder valve-gear together with its exhaust trunnion and gland, as well as the front end of the beam used to drive the air pump in the surface condenser layout, later adopted. The use of steam hydraulic reversing gear, and control from an upper starting platform was unusual in an engine of this size. The foot, or palm for the big-end, or crank-



A close-up of the reversing gear linkage



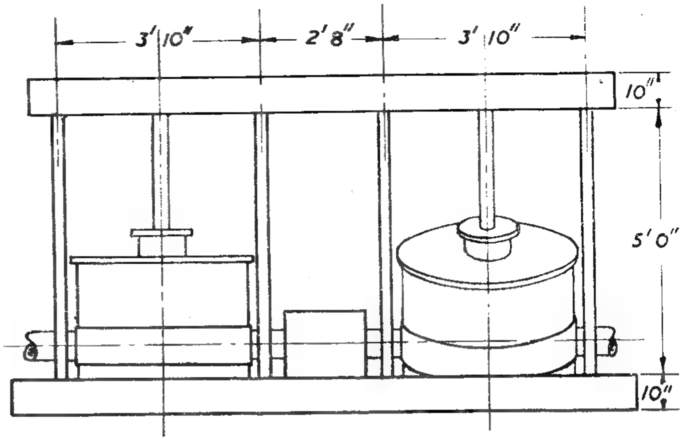
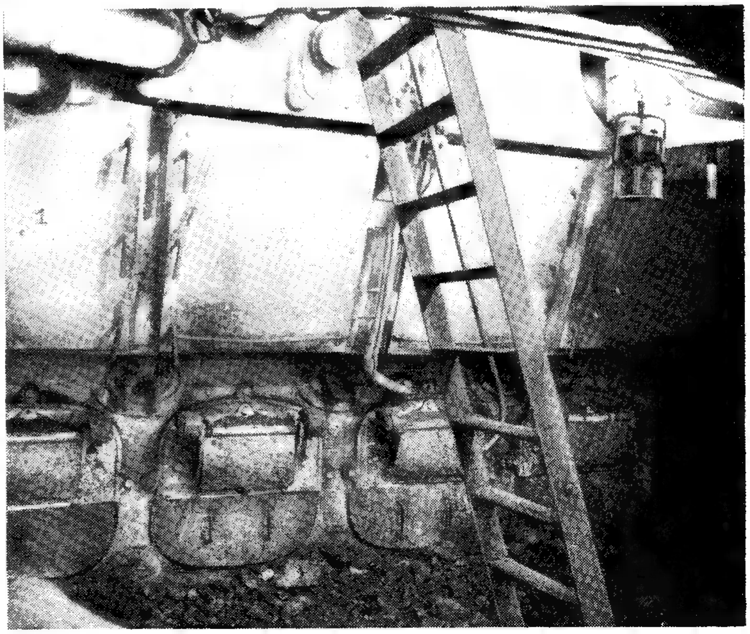


Fig. 1. Diagram showing the principle dimensions

pin bearing, was a bronze casting, cottered to the piston-rod, but in some cases the foot was forged from the rod itself. The centre-crank was forged in one with the half-crank for each cylinder, the crankpins being held by shrinkage and a locknut. The paddle shaft webs fitted over the crankpins and had bronze outer caps, over the pins.

Each cylinder had its own throttle-valve, both controlled from one lever. A delightful feature was the use of the Penn nut (Fig. 2), consisting of a bronze nut in one, with a filleted washer, each nut being a piece of individual craftsmanship. An interesting feature in the design, was that the valve-chests were in one with their covers, i.e., there was no top cover bolted on. The valve setting had to be done by trammels, and the more usual visual setting was impossible. Although built as a jet condenser, she did not stay thus for long, as in 1888, the hull was lengthened, and she was converted to surface condensation. The surface condenser was fitted close to the engine, the original air-pump was removed and the exhaust steam transferred through the old jet-chamber and air-pump barrel, and thence by a copper pipe to the new condenser. A centrifugal circulating pump was fitted, and the centre crank used to drive the new air-pump, which, being close to the new condenser, was driven by a lever as seen in the photograph. The conversion was a great improvement, although it is interesting to note that her long-lived sister ship *Premier* (hull built 1846, re-engined 1878 and broken up in 1938) was probably jet condensing all her career.

The boiler was very interesting, being a reminder of the spacious days when the boiler shape was made to suit the available cross section of the ship. In *Victoria* it certainly was so, as the sketch Fig. 3 shows, and the dimensions in Fig. 4 show it to have been a massive piece of work. Built by Hodge & Sons in 1912, the new boiler was the same as the original a fine piece of the plater's art. Most of the corners were of angle iron, and throughout, the stays, vertical and horizontal were a little more than a foot apart. Like many other good ships she was hard driven during the war, and this caused a good deal of salting of the tubes, and the wing banks under the inward sweep to the steam dome were impossible to reach until the tubes were drawn. A manhole 12 in. by 10 in. was fitted between each furnace top and at the end—five in all; also five mud doors below the furnaces. Each furnace was 2 ft. 6 in. wide, 2 ft. 9 in. deep and 6 ft. 0 in. long, and made in two plates, the joint being



View showing the rectangular boilers

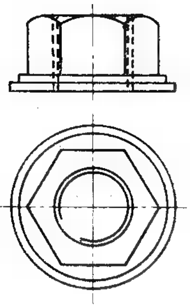


Fig. 2. The Penn nut. Washer and nut were in one piece

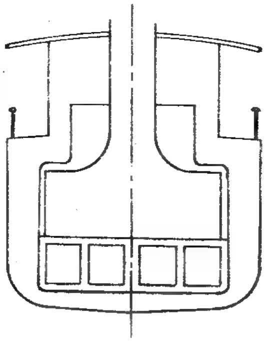


Fig. 3. Boiler and bunkers just fitted the ship

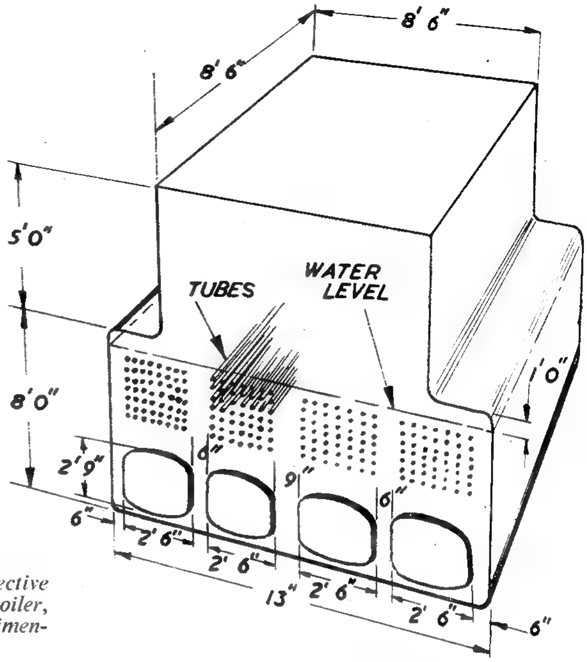


Fig. 4. Perspective diagram of boiler, giving main dimensions

below the firebars, but above the ashpit bottom. The usual combustion chambers were fitted, the gases returning to the smokebox by 435 2-in. tubes. The stokehold view shows the cast-iron furnace fronts, with the smokeboxes above, also the water gauge can be seen behind the stokehold ladder. Each cylinder had its own steam pipe, that for the starboard cylinder being seen in the top left-hand corner. They were rope lagged, being about [illegible] in. bore.

The whole was a delightful piece of craftsmanship, with the boilers working at a pressure of 30 lb. per sq. in., together with Penn's grand engines. The old ship has given delightful sea trips to countless thousands, although Lulworth's choppy seas were not always kind to the passengers. And so, like man she disappears from human ken; like him too, to meet rebirth in a new sphere at the Creator's will.

CENTRIFUGAL CASTING

(*Continued from page* 571)

There is an endless list of things to cast, both useful and ornamental.

General Hints

If you are washing a little cast under a tap and over a sink; it is a wise precaution to insert the plug in the basin, or else, should a tiny cast escape your fingers it may be carried down the waste-pipe by the current of running water. This has been known to happen.

When casting a larger model, the sprue-way should be made correspondingly larger by using thicker wire; also a larger ingot will be required. And it is advisable to have a larger ingot than the model to be cast; more cold metal should not be added to that already melted before casting. The whole heap of scrap or sheet should be properly melted up into one piece before putting over the sprue-way.

After brushing off the plaster, having just dug a job out that has been cast in copper or gold, it should be warmed up a bit over your bunsen, then dropped into some hydrochloric acid kept in a gallipot or empty stone jam-jar, for a few seconds. Then take it out by aid of tweezers, and wash with water, when all the black and discoloration will have vanished, showing clean metal. But you should have a saucer over the top of the acid-pot, as the fumes arising from the acid on the warm metal, will cause rust to appear on any iron or steel in its vicinity.

When soldering anything, it should be remembered that both the parts to be united should be of the same temperature to ensure a successful join.

Aluminium may be used as a casting metal, but it is not such an easy-flowing metal, and it is also a bit more difficult to work and to melt. Should you be casting something rather large, it is advisable to have more than one sprue-way, but they must all lean towards a common centre.

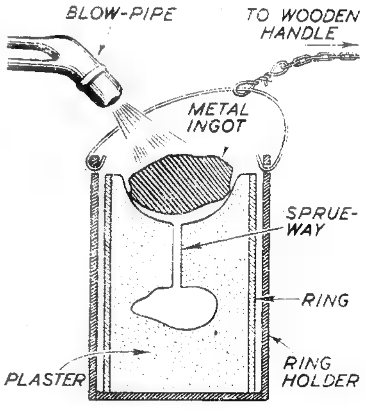


Fig. 2.

Aluminium may be cleaned white by warming and inserting in a gallipot of caustic soda, afterwards washing off carefully.

A FINE-FEED GEARBOX

DETAILS OF A USEFUL ADDITION TO A SIMPLE SCREWCUTTING LATHE

By Chas. H. Toogood

HAVING got "browned off" continually changing the gears from screwcutting to fine feed, I decided I would have to fit a gearbox. My lathe is a 4¼ in. Corbett X.L., and as the centre of the leadscrew was 1¼ in. from the front of the lathe bed, the largest gear that could be used, allowing a little clearance, was 2½ in. diameter. Having a 20 d.p. gear cutter, I decided to use 20 d.p. gears.

As I required as big a reduction as possible, I decided to use 15—45 + 15—45 which would give a ratio of 9 to 1. My favourite thread is 24 t.p.i., and with the leadscrew geared for this pitch, the extra gear reduction gives a fine feed of 216 t.p.i. I made some rough sketches, and decided to make the gears first, as my only gear cutter is a No. 5, and I knew the 15-tooth gears would require filing after gashing with this cutter, to make them run smoothly. If the gears did not turn out satisfactorily, I was going to send blanks away to be cut, while making the other parts. Blanks were turned, 0.010 in. oversize all round, bored 5/16 in., and the teeth cut.

Gear Spacing Jig

A piece of 1 in. × ½-in. steel, 6 in. long had two holes drilled and reamed 5/16 in. diameter at 1½ in. centres to serve as a jig. Two short pieces of 5/16-in. silver-steel were driven in these holes, and a countersunk hole drilled near each end, for screws to hold it down on the bench. One pair of gears were put on these pins, and the teeth filed until they revolved fairly smoothly.

The other pair were then treated in the same way. A piece of heavy angle-iron was drilled at 1½ in. centres, one hole being tapped 5/16 in. B.S.F. and the other hole drilled ½ in. diameter. The 5/16-in. hole was fitted with a 5/16-in. stud, which was also drilled for a split-pin. In the ½-in. hole was pressed a bronze bush, which was reamed 5/16 in., with an oil-hole and groove. The angle bracket was bolted down on the bench near the lathe.

A piece of 5/16-in. round steel was knurled at one end and driven in a 15-tooth gear, the spindle being pushed through the bush and a flat pulley fitted.

The 45-tooth gear, making the pair, was put on the stud and a split-pin fitted; finally, a flat belt was fitted to drive the pulley from the overhead shafting.

After coating the gears with fine grinding paste, they were run in for about three hours, while other parts were being made. The gears were then washed in paraffin, and being placed on the pins on the steel jig, it was found they ran very smoothly. The other pair were treated in the same way. As the gears were satisfactory, they were set up in the lathe to finish machining.

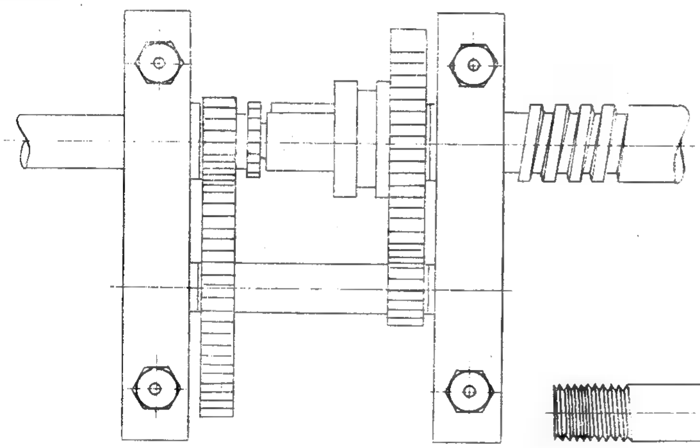
For mounting the 45-tooth gear, a piece of ⅜-in. plate was bolted to the faceplate. This was bored out so that the 45-tooth gears could be pushed in to a depth of ¼ in., and clamped by two plates, with bolts through the faceplate.

The boss was then faced, and using the dividing attachment on the headstock, 15 holes, 9/64 in. diameter were drilled on a 21/64-in. pitch circle with a drilling spindle mounted on a slide-rest to a depth of ¼ in. The boss was then bored out ⅝ in. diameter. The other 45-tooth gear was next mounted in the plate, and clamped down and bored ⅜ in.

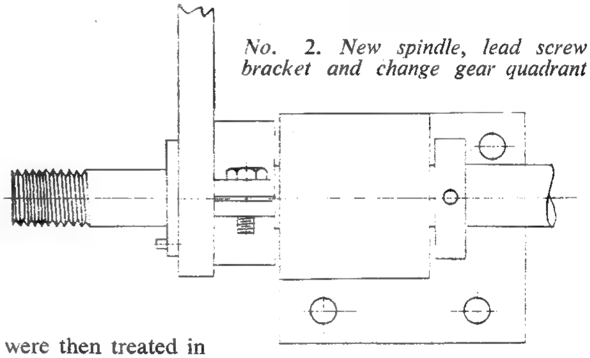
A smaller piece of plate was bolted to the faceplate and bored out to fit the 15-tooth gears in the same way. Both gears in turn were pushed in, clamped to the faceplate and bored ⅜ in. diameter. The 45-tooth gears were mounted on a mandrel and machined all over to dimensions shown in sketches Nos. 8 and 10, after which the 15-tooth gears were similarly mounted and machined all over, as per sketches Nos. 9 and 11.

The teeth on the reduced part of the 15-tooth gear were shaped half-round, to fit in the half-round holes in the sliding gear, by means of a forming-tool held in the toolpost. By means of a keyway-cutting attachment set up on the lathe, the keyways were cut in all gears.

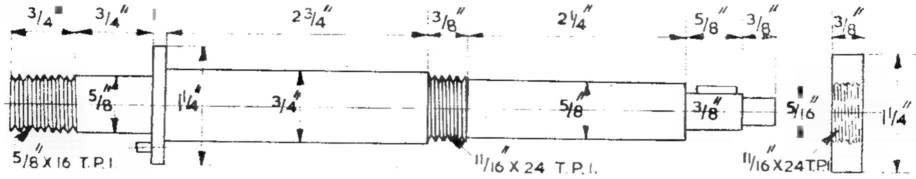
The layshaft was next machined,



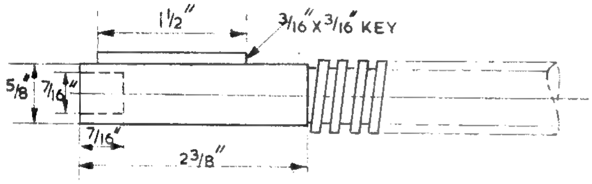
No. 1. Gear-box (cover removed)



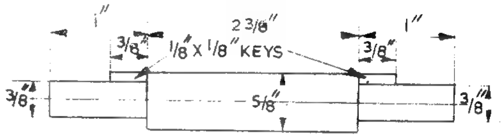
No. 2. New spindle, lead screw bracket and change gear quadrant



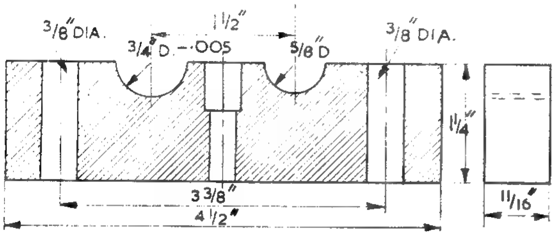
No. 3. Spindle and lock-nut—mild-steel



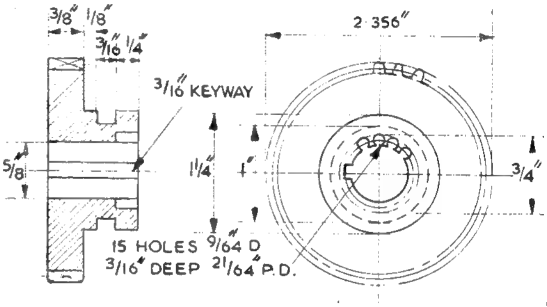
No. 4. Alterations to leadscrew



No. 5. Layshaft

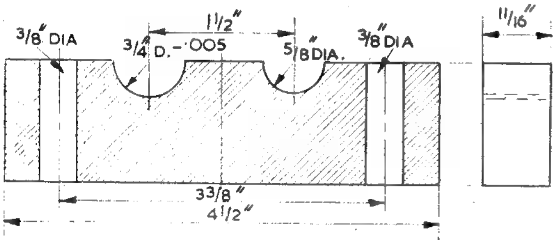


2 OFF EACH

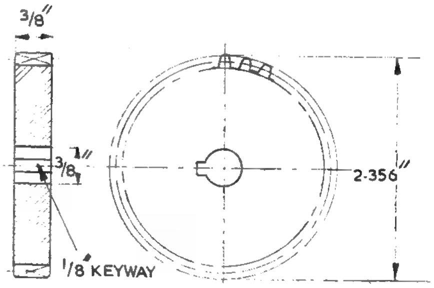


45 TEETH 20 D P.

No. 8. Sliding gear—45 teeth, 20 d.p.

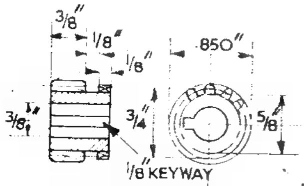


Nos. 6 and 7. Side plates



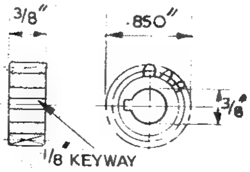
45 TEETH 20 D.P.

No. 10. Layshaft gear—45 teeth, 20 d.p.



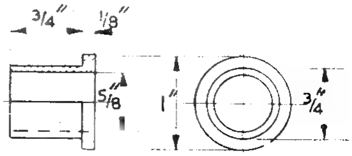
15 TEETH 20 D.P

No. 9. Small driving gear, 15 teeth



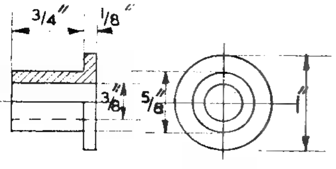
15 TEETH 20 D.P.

No. 11. Layshaft gear—15 teeth, 20 d.p.

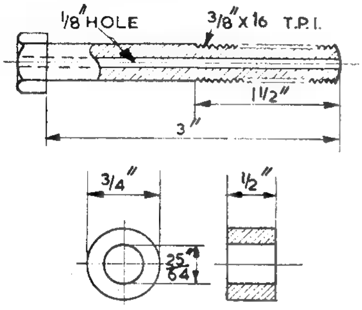


2 OFF P. BRONZE

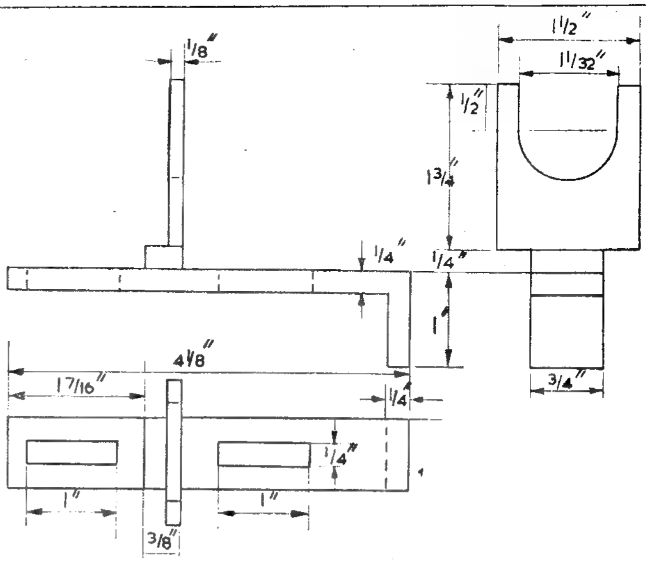
No. 12. Bushes for top shaft



No. 13. *Bushes for layshaft*



No. 17. *Bolts and distance-pieces for drilling lathe bed* (4 *off, steel*)



Nos. 14, 15 *and* 16. *Operating lever*

as per sketch No. 5, and the gear keyed on, after which the main drive spindle was machined as in sketch No. 3, also the adjusting nut.

Gear Frame

For constructing the side-plates, four pieces of iron $4\frac{5}{8}$ in. × $1\frac{1}{2}$ in. × $\frac{3}{4}$ in. were machined all over, till they finished $4\frac{1}{2}$ in. × $1\frac{1}{4}$ in. × $\frac{11}{16}$ in. Two had $\frac{3}{8}$-in. holes drilled at $3\frac{3}{8}$ in. centres, and the other two had $\frac{3}{8}$ in. tapped holes similarly spaced. These were screwed together in pairs, marked out, and bored out on the faceplate, as per sketches Nos. 6 and 7.

Four steel bolts 3 in. × $\frac{3}{8}$ in. were drilled down the centre with an extra long $\frac{1}{8}$-in. twist drill; this was done from the threaded end, as it is essential the holes should be true at this end. Four distance-pieces were made from $\frac{3}{4}$-in. diameter steel, $\frac{1}{2}$ in. long, and drilled $\frac{3}{8}$ in.

The leadscrew was partly withdrawn, and the two parts having the centre counterbored holes were held against the front of the lathe bed, and the leadscrew pushed back in position. The other two parts were placed in position with the distance-pieces over the bolts, which were screwed in finger-tight.

A piece of $\frac{3}{8}$-in. round steel was inserted through the $\frac{3}{8}$-in. holes and the bolts tightened down. The headstock was then removed, and with a square placed upside down on the headstock seating, the side-plates were set square and thin pieces of packing interposed behind them. By means of the long $\frac{1}{8}$-in. drill, inserted through the hollow bolts, pilot holes were drilled in the lathe bed.

The leadscrew and side-plates were then removed, and with the aid of a ratchet drill and bracket, the $\frac{1}{8}$-in. holes were opened out to $\frac{5}{16}$ in. and tapped $\frac{3}{8}$ in. × 16 t.p.i., also spot-faced $\frac{5}{8}$ in. diameter. All three operations were done at one setting, which ensured everything being true.

A $\frac{3}{8}$-in. reamer was put through the $\frac{3}{8}$-in.-0.005 in. holes and the $\frac{3}{8}$-in. threads were drilled out of two back halves. These two parts were placed in position, using short bolts to hold them to the bed. A number of washers were cut from brass foil, $\frac{5}{8}$ in. outside diameter, and $\frac{3}{8}$-in. bore; these were interposed between the sides and the lathe bed, on the spot-faced surfaces, and bolts pushed through them. The number of washers was adjusted, till, with the bolts tightened, the leadscrew would just turn freely. The leadscrew was withdrawn, a 7/32-in. drill put through, the centre holes and the bed drilled and tapped $\frac{1}{4}$ in. × 26 t.p.i. Allen cap-headed screws were placed in position, and tightened down, after which the bolts were removed. The four phosphor bronze bushes were machined as per sketches Nos. 12 and 13.

Alterations to Leadscrew

The leadscrew was marked where it required cutting. A pair of bronze bushes bored $\frac{3}{4}$ in. diameter were inserted in the ends of tailstock barrel to act as a steady, in which the leadscrew could run, with the change wheel end in the three-jaw chuck. It was then turned down, to $\frac{5}{8}$ in. diameter as per sketch No. 4. The leadscrew was then cut through, inserted through the tailstock again, and the part turned down to $\frac{5}{8}$ in. clamped down to a vee-block on the slide-rest, to enable the end to be centred, drilled $\frac{7}{16}$ in. diameter and $\frac{7}{16}$ in. deep and spot-faced.

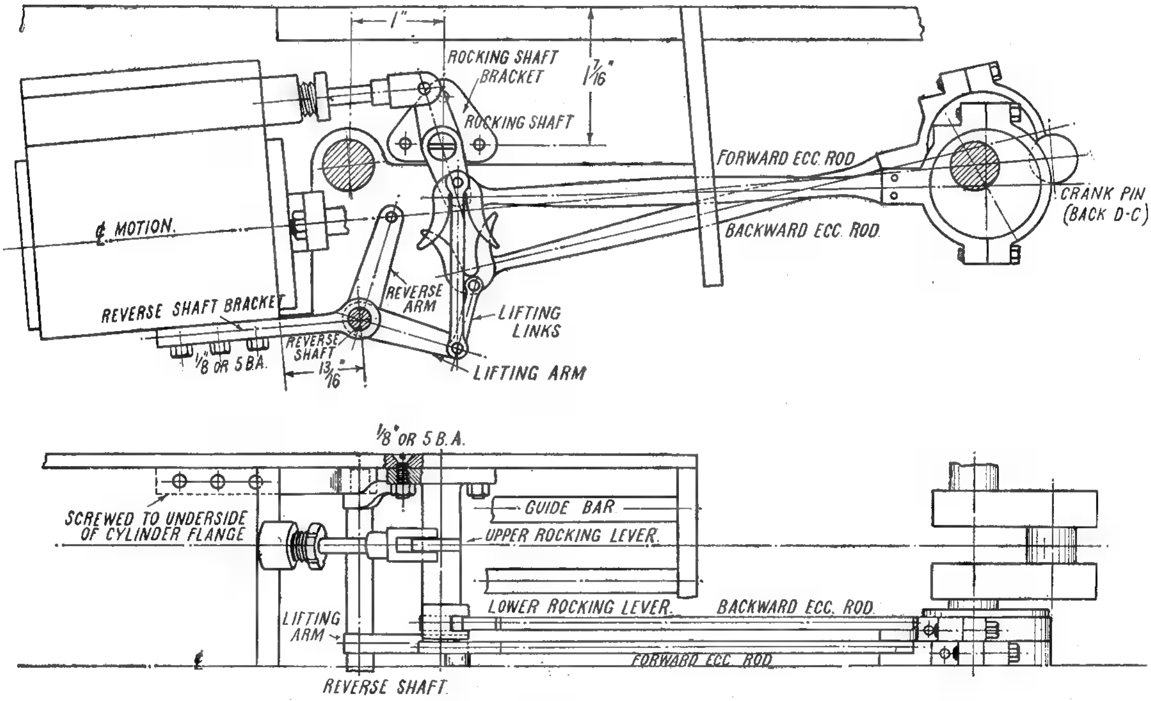
A phosphor bronze bush was turned $\frac{7}{16}$ in. diameter, and bored $\frac{5}{16}$ in. diameter. This was pressed in the end of the leadscrew, and an oil-hole drilled; oil-holes $\frac{1}{16}$ in. diameter were drilled in the extreme end of each bush at the opposite end to the flange. The existing leadscrew bracket was removed, held in the chuck, and the rear end, faced, as it was a rough casting. The bracket was replaced, the gearbox assembled, and the leadscrew fitted. The lathe was run, and I was very pleased that it ran very quietly. The operating lever was then made, as shown in sketches Nos. 14, 15 and 16.

The cover is in two pieces, comprising the top half cover, of 20-gauge iron bent at right-angles, with slots to push under the two top bolt-heads; and the bottom half, which is similar, but has holes instead of slots, so the bolts have to be removed to enable it to be fitted. Since making this gearbox, I have fitted a shaft at the rear of my lathe, from which a worm drive is taken to the feedscrew of the slide-rest, so I also have a self-acting cross-feed.

L.B.S.C.'s Titfield Thunderbolt

IN 3½ AND 5 INCH GAUGES

NOW we come to a really interesting part of the old-timer, to wit, the gab valve-gear. This was the direct forerunner of the link motion, and was fitted to many engines; but it has always seemed strange to your humble servant, that quite a time elapsed before somebody did the obvious thing, and coupled the ends of the eccentric-rods with a slotted link. The usual version of the gab motion didn't



Gab valve-gear for the 5-in. gauge engine

have separate lifting arms like those shown here, the gabs being joined by a spacer bar; and one lifting link for each side of the motion, did the needful. I wonder that some bright spark didn't replace the spacer bar with a link, and pitch the gabs on the scrap heap! Whilst the gab motion illustrated here, is a faithful copy of the original, as far as the actual working parts are concerned, I have had to make drastic alterations to the brackets, to make the outfit a good working proposition, in the small size. On not-so-big sister, the rocking-shaft was a comical-looking gadget supported by two brackets attached to the back of the smokebox. The reversing-shaft only extended halfway across the frames, and at the end carrying the reversing arm, it was supported by a small bracket fixed to the cylinders. At the other end, a huge triangular doings like an inverted gallows, was bolted to the cylinders, right on the centre-line, and supported the end of the shaft, which carried the motley collection of arms, levers and links that did the actual reversing. As it would have been useless to attempt to copy this, as a working proposition in the small engine, I had to do a bit of redesigning, and have wangled out an arrangement that is easy to make and fit, is workable, and bears the characteristic stamp of the period. In doing so, I fully realised the truth of my good friend the retired C.M.E.'s remark that a little locomotive, to be a real success, must be designed to suit the rail gauge. I'll say it must ! ! To avoid any chance of 3½-in. and 5-in. gauge builders getting mixed up with dimensions, I'll deal with each size separately, circumstances and the K.B.P. permitting; so here, as a kick-off, are the drawings and notes for the gab motion of the 5-in. gauge "Tit."

General Arrangement of the Gear

Curly doesn't preach one thing, and practise another, so here are three views of the whole bag of tricks, which should enable the

veriest "Billy Muggins" to "take it all in" with the minimum of trouble. There are two eccentrics per cylinder, of the ordinary type, one set for forward gear and the other for backward gear. Each eccentric-rod carries a hook or gab at the end, the openings of which, face each other. Above them is a rocking-shaft, the upper lever of which drives the valve-spindle. The lower lever carries a pin, with which the gabs engage. When the upper gab is hooked over the pin as shown, the latter naturally follows the movement of the eccentric, which is set for going ahead. When the driver pulls the lever back, to reverse, the lifting-arm is raised, pushing the upper gab clear of the pin, and bringing the lower gab into engagement with it. The

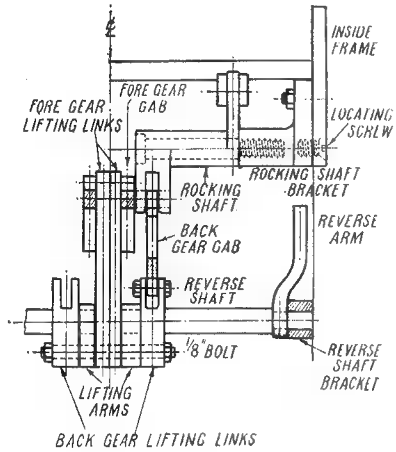
overhang of an unsupported driving-pin, and the stress on it when in forward gear. The cross section shows how the outer jaw comes between the two gabs and supports the pin, eliminating any bending stress. The big central triangular bracket has been displaced by two small straight brackets, screwed to the underside of the cylinder casting, and supporting a reversing-shaft which extends the full width of the frames. This renders it very easy to erect and connect up. One long bolt through the ends of the lifting arms, supports all four lifting-links.

Eccentric-straps, Rods and Gabs

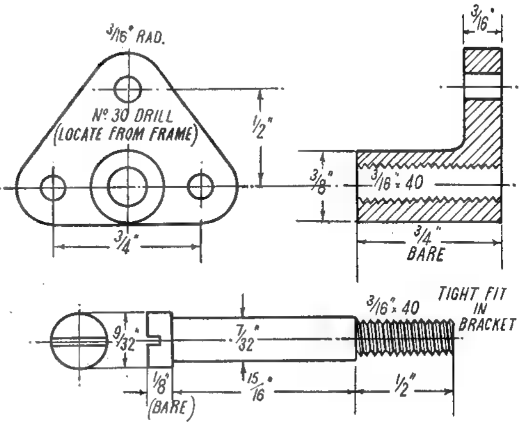
The eccentric straps, and the "fish-bellied" rods as far back as the eyes, are made exactly as described for the loose-eccentric-gear,

filed to the outline shown. The hole for the lifting-pin in the two forward-gear gabs, can either be drilled No. 32, or drilled No. 40 and tapped $\frac{1}{8}$ in. or 5 B.A.; the hole in the backward-gear gabs should be drilled No. 32 and reamed $\frac{1}{8}$ in.

If mild-steel has been used for the gabs, case-harden them by heating to bright red, and rolling in any good case-hardening powder, such as "Kasenit," "Pearlite," etc., giving them about three doses apiece. Clean the part where they join the eccentric-rods, then butt the rod to the gab, so that the centre of what was the drilled hole, lines up with the centre of the rod; then braze the joint. Just lay the parts together on a bit of asbestos millboard in the brazing-pan, put a spot of wet flux (Boron compo, or some-



End view of the gab motion for the 5-in. gauge engine



Rocking-shaft bracket and pin for the 5-in. gauge engine

sloping sides of the gab, guide the pin to its working position; the pin then follows the movement of the other eccentric, which is set for going backward. There is no intermediate working position, the engine always running in full gear, speed being regulated by the amount of steam admitted to the cylinders. The full-sized engine cuts off at 81 per cent. of the stroke, but I have arranged the small one to cut off much earlier, so that she is more economical in proportion to size.

In place of the weird and wonderful arrangement of rocking-shaft and brackets fitted to the full-size job, each set of gear on the little engine has one simple cast bracket bolted to the frame; this carries a double-armed rocking-shaft of simple design, the lower arm of which is forked, like the full-sized one, for the same purpose of preventing the excessive

so we needn't waste space with needless repetition. In place of the eye, each rod carries a gab, made as shown. They can be cut from $\frac{1}{8}$ in. flat steel; either the fine cast steel used for gauge-making (ground flat stock) or mild-steel. If the latter, they should be case-hardened before brazing them to the eccentric-rods. The easiest way to cut them out, is first to mark the outline, and drill a $\frac{3}{16}$-in. hole at the point where the pin will engage. The inside of the jaws can then be filed to the shape shown, taking great care to avoid touching the upper half of the drilled hole. Note: the jaws don't begin the splay out from the centre of the hole, but from a point $\frac{1}{8}$ in. below it. There is $\frac{1}{8}$ in. of parallel at each side, same width as the hole, before the outward curve begins. See to this first; then the outside of the gab can be sawn and

thing similar) on the joint, heat to bright red, and melt a spot of brass wire, or Sifbronze, into it. Continue heating until the brazing material has penetrated; then quench in clean cold water while the gab is still dull red. This will harden it, whether made of cast or case-hardened mild-steel. Knock off any burnt flux, clean up, and fit $\frac{1}{8}$-in. silver-steel pins to the forward-gear gabs.

Don't forget, when attaching the eccentric-rods to the straps, that two of the gabs should be "horns down," and two "horns up." The latter are those without lifting pins. Two of the eccentric-straps have the lugs rebated on one side, and two on the other; the plan drawing shows which is which. The rebates can easily be endmilled by clamping the straps under the slide-rest tool-holder, and running them under an

end-mill with side teeth, held in the three-jaw. Do the assembling on a jig, to ensure all four being exactly the same length; the jig is just a piece of flat bar (anything that may be handy) with a $1\frac{1}{8}$-in. disc riveted to it, and a $\frac{3}{16}$-in. pin pressed into a No. 14 drill-hole, the two being set at $5\frac{3}{8}$ in. centres. When the eccentric-strap is placed over the disc, the gab should go right home on the pin. Attach the eccentric-rods to the straps, as described for the loose-eccentric gear.

Rocking-shaft and Bracket

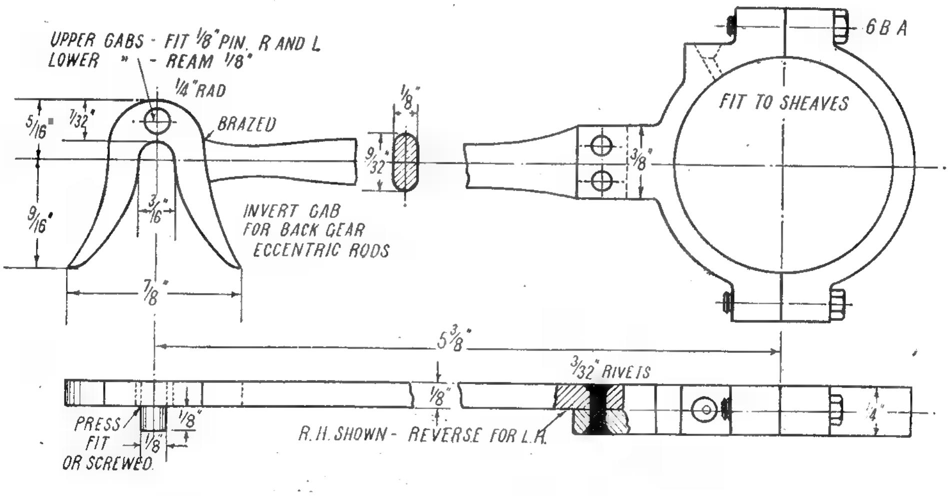
Our enterprising advertisers will probably supply castings for both brackets and shafts; if so, it saves the trouble of building them up. Cast brackets can be held by the flange in the four-jaw, with the boss set to run truly; face the end, true up the boss, and face the flange. Rechuck with the turned boss in the three-jaw; face the contact side of the flange, centre, drill right through with No. 22 or 5/32-in. drill, and tap $\frac{3}{16}$ in. × 40. Don't drill any screwholes. To build up a bracket, cut the triangular flange from $\frac{3}{16}$-in. plate, mark off the location of the boss, and drill a small hole at the mark, say No. 30.

up with a file, and chuck truly in four-jaw, forked lever outwards. Face, centre, drill right through with No. 5 drill, ream 7/32 in. and counterbore with a 9/32-in. pin-drill or D-bit to $\frac{1}{8}$ in. full depth. File or mill the slot in the upper lever, to $\frac{3}{16}$ in. width, and fit a die-block as described for the loose-eccentric gear.

To build up the rocker, cut the slotted lever from $\frac{1}{4}$-in. × $\frac{3}{8}$-in. mild-steel; drill a 9/32-in. hole in the lower end. The forked lever is cut from $\frac{3}{8}$-in. × $\frac{3}{8}$-in. mild-steel, by drilling and slotting the end of a piece of bar, as described for valve gear parts such as combination levers; cutting off to full length, and milling or filing to the shape shown. The solid end is drilled 9/32 in. and be quite sure that the hole goes through dead square. "Sure, an' whin does a round hole go square?" says Pat. We'll leave him to puzzle that one out, while we turn the sleeve, which is a piece of $\frac{3}{8}$-in. round rod, steel or bronze, $\frac{15}{16}$ in. long. Chuck in three-jaw, centre, drill No. 5 and ream 7/32 in. Turn $\frac{1}{8}$ in. of the end to a tight fit in the forked lever; reverse in chuck, and turn $\frac{1}{8}$ in. of the other end to a tight fit in the slotted lever. Press

The jaws of the forked lever are drilled No. 14, and a $\frac{3}{16}$-in. silver-steel pin, $\frac{1}{2}$ in. long, is pressed in as shown, leaving a $\frac{1}{8}$ in. projection. Alternatively, the jaws can be drilled 5/32 in., the outer one opened to $\frac{3}{16}$ in., and the inner one tapped $\frac{3}{16}$ in. × 40, the end of the pin being screwed to suit. The thread should be tight, so that there is no chance of the pin coming adrift halfway between Titfield and Mallingford Jct., and causing the worthy bishop to say something he wouldn't say in the pulpit, to the great delight of the bus company! The edges of the fork should be relieved slightly as shown, see section, to allow the back-gear gabs to smack well home on the pin. The die-block in the slotted lever is as mentioned previously.

The pin, or spindle, is a simple turning job, made from $\frac{5}{16}$-in. round mild-steel. Chuck in three-jaw, turn $\frac{1}{2}$ in. length to $\frac{3}{16}$ in. diameter, and screw $\frac{3}{16}$ in. × 40. The threads should be a very good fit in the bracket. Turn down $\frac{15}{16}$ in. full length to 7/32 in. diameter, to fit nicely in the sleeve of the rocker, and part off at a full $\frac{1}{8}$ in. from the shoulder. Reverse in chuck, reduce the head to 9/32 in. bare diameter,



Eccentric strap, rod and gab for the 5-in gauge engine

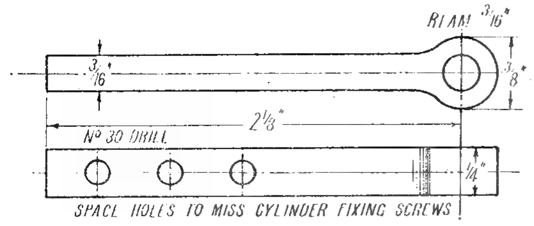
The boss is made from a $\frac{3}{8}$ in. length of $\frac{3}{8}$-in. round rod. Chuck in three-jaw and turn a pip on the end, $\frac{3}{16}$ in. long, to fit tightly in the hole in the flange. Squeeze it in, and if you have used steel for the parts, braze the joint; if brass or gunmetal, silver-solder it. Chuck the boss in the three-jaw, and drill and tap it as above, right through the lot.

If a cast rocker is used, clean it the levers on, setting them exactly opposite, brazing the joints if steel has been used, or silver-soldering if bronze or gunmetal. If any brazing material seeps through into the counterbore, clean it out with a 9/32-in. pin-drill or D-bit, otherwise the sleeve won't seat right home on the pin when assembled. Don't forget to drill the oil holes in the sleeve, whether cast or built-up.

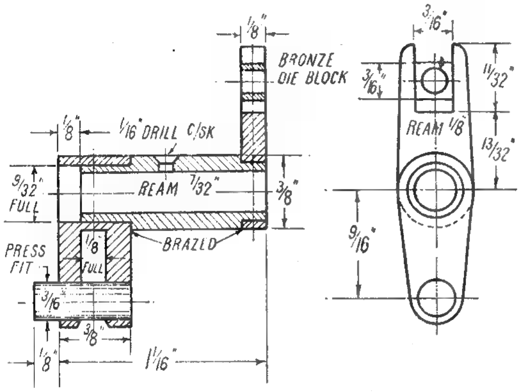
face off truly, and cut the slot with a hacksaw or thin flat file.

Reversing-shaft and Brackets

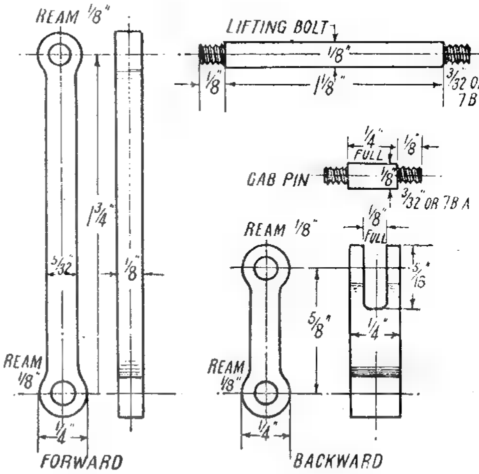
The reversing shaft is a $4\frac{1}{8}$ in. length of $\frac{1}{4}$-in. round mild-steel faced off truly at both ends. Chuck in three-jaw, and turn $\frac{3}{8}$ in. length to $\frac{3}{16}$ in. diameter; reverse in chuck, and turn $\frac{1}{4}$ in. of the other end likewise. The two lifting arms are cut



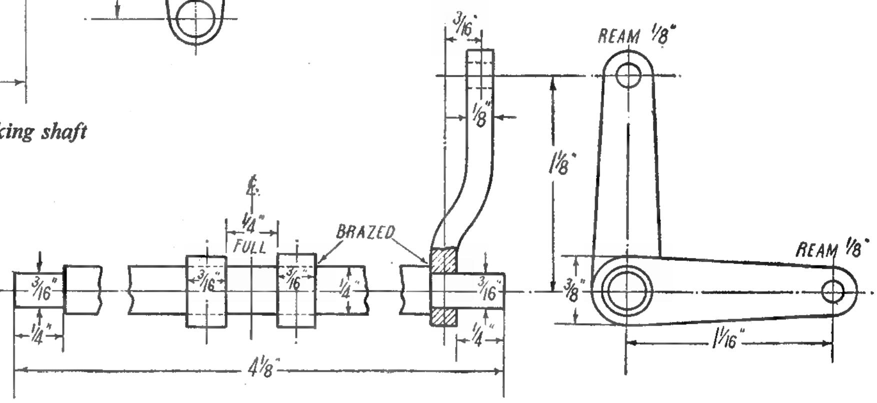
Reverse shaft bracket



Rocking shaft



Lifting links



Right: Reversing shaft for the 5-in. gauge engine

from $\frac{3}{8}$-in. × $\frac{3}{16}$-in. mild-steel, to the shape shown, the larger ends being drilled a tight push fit on the shaft. The smaller ends are drilled No. 32 and reamed $\frac{1}{8}$ in. Press the arms on the shaft, so that they are $\frac{1}{8}$ in. at either side of the centre-line, and make certain that they are exactly parallel, by putting a piece of $\frac{1}{8}$-in. silver-steel through both the end holes at once.

The reversing arm is cut from $\frac{1}{8}$-in. × $\frac{3}{8}$-in. mild-steel, and set over as shown, to clear the guide-bars when erected. The small end is reamed $\frac{1}{8}$ in. and the larger end is drilled to fit tightly on the longer spigot of the reversing shaft. Squeeze it on, and set it at right-angles to the lifting arms; then braze the joints, and clean up.

The brackets may be cast, or made from $\frac{1}{4}$-in. × $\frac{3}{8}$-in. mild-steel, milled, or sawn and filed, to the shape shown; alternatively, the straight part may be made from $\frac{3}{16}$-in. × $\frac{1}{4}$-in. mild-steel, with a $\frac{3}{8}$ in. boss, either mild-steel or bronze, brazed or silver-soldered to the end. The holes should be an easy fit, but without shake, on the reduced ends of the reversing shaft. Before drilling the holes for the fixing screws, try the brackets temporarily in position, on the underside of the cylinder side flanges, and see that the screws holding them in place won't run foul of the screws holding the cylinders to the frames.

Lifting Links

The two long lifting links are milled, or sawn and filed, from $\frac{1}{8}$-in. × $\frac{1}{4}$-in. mild-steel, to dimensions shown; a simple job requiring no detailing out. The shorter forked links are made from $\frac{1}{4}$-in. square steel. Slot them out as described for valve-gear forks on *Tich* and other engines described in these notes, and saw or part off a full $\frac{7}{8}$ in. from the ends; then file or mill to shape shown. To make a button jig for guiding the file when rounding the ends, chuck a bit of $\frac{1}{4}$-in. round silver-steel in the three-jaw, and turn a little pip on the end, to fit the hole in the link. Part off at $\frac{1}{4}$ in. from shoulder, then ditto-repeato the operation. Harden the buttons right out, by heating to red and plunging in cold water. Put one at each side of the end to be rounded, hold the lot in the bench vice, and file away the projecting bit of link, until the file hits the buttons. This wheeze is as old as the hills, but judging from some of the awful "rounded" ends I've seen on valve gear parts, it doesn't seem to be generally known, especially among beginners.

The pins and bolt for connecting up the links to the reverse arms and gabs, are made from $\frac{1}{8}$-in. round silver-steel, reduced to 3/32 in. at

the ends, screwed 3/32 in. or 7 B.A., and furnished with ordinary commercial nuts. They should be free enough to turn by finger-pressure, when the nuts are tight against the shoulders.

Erection and Valve Setting

First of all, poke the pins through the rocking shafts, and screw them home into the brackets. When the pins are right home, the rockers should be quite free, with just the weeniest bit of end play. Remove the cylinders and drop the leading wheels, as described for the loose-eccentric gear, exposing the locating holes in the frames. Countersink these, and fit the brackets by running $\frac{3}{16}$ in. × 40 countersunk screws, through the holes in frame, into the tapped holes in the brackets. Set the bottom line of the brackets level with the edge of frame, then drill three No. 30 holes in a triangle (shown in the drawing of bracket) clean through the frame and the bracket flange; countersink them, and put in $\frac{1}{8}$-in. or 5-B.A. countersunk screws, nutting them on the inside. Replace cylinders, and connect the valve spindles to the die-blocks in the slotted levers, as described for the loose-eccentric gear.

Put the reversing-shaft brackets on the ends of the shaft, and screw the brackets to the underside of the cylinder flanges, as shown; the shaft should move freely, but without shake, when the screws are tight. Now fit the eccentric straps to the sheaves, as described for the loose-eccentric gear, and be sure you get them on the proper sheaves; the "horns down" gabs are nearest to middle, and the eccentric-rods should be as shown in plan. Attach the forked lifting-links to the back-gear gabs by the small pins, and hang the long single lifting-links on the pins in the fore-gear gabs. The bottom ends of these, go between the lifting arms on the reversing shaft, and the lower ends of the short forked links outside the arms; see end view. Put the long bolt through all the lot, as shown; put the nuts on, and Bob's your uncle once more.

When the bent reversing arm on the end of the shaft, is worked back and forth, the gabs should engage the pins easily, the pins sliding up and down the horns, when the gabs are not exactly opposite; any stiffness would probably be due to the glands being tight, and holding the spindles. That is easily remedied; but in any case, the spindles will be free enough when once the engine has been in steam.

Setting the valves is just a piece of cake. Take off the steamchest cover, and adjust the valves for equal port opening, as described for the loose-eccentric gear; then, with the top gabs engaging the pins, take off the back half of one of the eccentric-straps, and adjust the set-screw so that you can just move the eccentric. Hold the front half of the strap tight against the eccentric, and with the crank on front dead centre, turn the eccentric in a forward direction until the valve first closes the port, and then comes back and shows the crack, as described for the loose eccentric setting. Temporarily tighten the set-screw; then, still holding the strap against the eccentric, turn the wheels until the crank is on back dead centre. If the back port cracks (it should) all's well; if it doesn't, the valve isn't properly adjusted for equal port opening. If it can't be put right by turning the fork on the spindle, take a weeny shade off the valve laps. When the corresponding ports crack on the dead centres, the setting is O.K. The half of the strap can be replaced; but be sure that the set-screw in the eccentric is as tight as possible before doing this.

Each eccentric is adjusted separately, in similar manner. When doing the forward gear setting, see that the gabs are right down on the pins, and the reverse arm as far back as it will go; the arm inclines the opposite way to the direction of motion. When setting the back-gear, push the reverse arm right forward, and make sure the gabs are right up against the pins. Don't forget to turn the eccentrics in the proper direction! When all four are set, couple a tyre pump to the steamchest, as mentioned in the last instalment, and try how she goes under air pressure; the result should be gratifying.

Next stage, the gab motion for the $3\frac{1}{2}$-in. gauge engine.

Who's Who IN MODEL ENGINEERING

DR. T. FLETCHER

Few model engineers can claim a wider variety of interests in model engineering, or a more honourable record in the construction of distinguished models which have won premier awards in *THE MODEL ENGINEER* Exhibition and other exhibitions than Dr. Fletcher.

He was born at Ayr, in 1896, and educated at Ayr Academy and Glasgow University, where he qualified as a Doctor of Medicine. His interest in model engineering dates from the age of 12 and was largely fostered by the influence of his father, who was a skilled craftsman, and relatives in various engineering firms and shipyards. Living in a Scottish seaport, he had access to marine engines and other machinery.

His models include power-driven prototype and original ship models, steam locomotives, petrol engines, the latter mostly of original design. His 7-cylinder radial i.c. engine won a Silver Medal at *THE MODEL ENGINEER* Exhibition in 1946; his pilot cutter, with vertical twin 2-stroke i.c. engine, was awarded a cup at the 1948 exhibition, and his Clyde tug-boat, with compound engine, was also a cup winner in 1949.

He was President of the Bradford Society of Model Engineers from 1944 to 1946, vice president of the Huddersfield Society of Model Engineers, and founder and president of the Colne & District Society of Model Engineers during 1952 and 1953.

Among his other hobbies and pursuits may be mentioned fishing, including making all apparatus, cinematography, and music.

READERS' LETTERS

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

REVERSING ELECTRIC MOTORS

Dear Sir,—In your reply to W.K.W. (Hayes) (The Model Engineer, October 8th), you state that in the case of an a.c. motor, where the starting winding is tapped off half the running winding, reversal is not obtainable unless six ends are brought out. This is not correct. In this type of motor, the free end of the starting winding is taken through the centrifugal switch to one end of the running winding, and to reverse the motor it is only necessary to take it instead to the other end of the running winding, thus reversing the direction of the current through the starting winding without affecting the running winding, as shown in diagram *A* herewith. As the starting winding is fed *via* the centre point of the running winding, the voltage across the starting winding is unaltered.

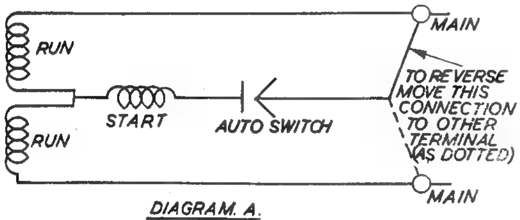


DIAGRAM. A.

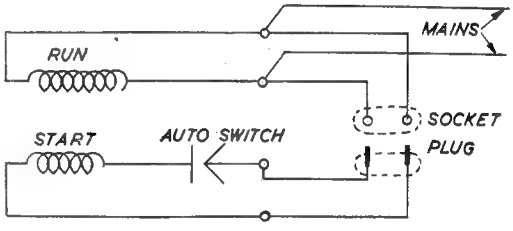


DIAGRAM. B.

A simple test to ascertain whether or not the starting winding is connected to the centre point of the running winding is as follows :

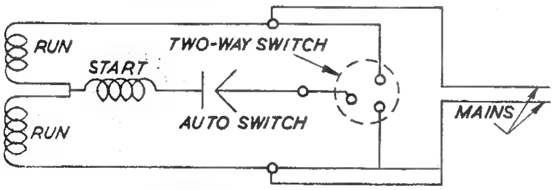


DIAGRAM C

Apply a voltage from a battery across the two ends of the running winding and take voltmeter readings between the end of the starting winding and each end of the running winding. (The end of the starting winding will always be found connected to one side of the centrifrugal switch).

If the readings obtained are the same, i.e., half the battery voltage, the starting winding is fed from the centre of the running winding. If the starting winding is fed from the end of the running winding the readings obtained will be full voltage and zero respectively.

In motors where only two wires are brought out, it will usually be found that the manufacturer has connected the starting winding and centrifugal switch permanently to the back of the connection block, bringing both ends of the running winding to the *same* two terminals on the front of the block, so that reversal may be obtained by changing over the two leads from inside the motor.

Readers who, like myself, do not wish to purchase an expensive reversing switch, may be interested in the sketches *B* and *C*. *B* shows a method of reversing a motor with a full voltage starting winding, where four leads are available, by using an ordinary 2-pin plug and socket. To reverse direction, the plug, which may be marked with an indicating arrow, is withdrawn from the socket and replaced the other way round, thus reversing the starting winding. *C* shows a method of reversing a motor with half voltage starting winding, in which an ordinary two-way tumbler switch is used. I have found both these methods to be successful.

Yours faithfully,
Bridlington. L. Binns.

PETROL BURNERS

Dear Sir,—Regarding J.H.B.'s (Bahrain), enquiry about a petrol burner for a marine boiler, is it not possible that a methylated spirit blowlamp which does not require pumping up, but is self-blowing, is what he requires ? I have made one or two (smaller than what seems to me necessary for a 5 in. diameter × 6 in. boiler, as a $1\frac{1}{4}$ in. diameter flue is, in my opinion, far too small) to a design in The Model Engineer about 1912-13. One which I have just tested in a bath has a burner tube of $\frac{7}{8}$ in. o.d. × 3 in. long, and the feed tube is $\frac{1}{2}$ in. o.d. × 4 in. long. This gives a very hot flame, and keeps a Stuart Turner Meteor engine $\frac{7}{16}$ in. × $\frac{7}{16}$ in. d.a. running at full speed at 60 lb. per sq. in., with the stop-valve fully open, driving a Remod propeller. This engine has a feed-pump driven at the same speed as the engine, $\frac{1}{8}$ in. diameter × $\frac{1}{8}$ in. stroke, but it will not deliver water into the boiler; possibly, because the stroke is too short, and the ram just compresses the air in the pipeline and then it expands again, despite all my efforts of getting rid of air in the system. I have, however, had very satisfactory results with a direct-driven feed-pump, $\frac{1}{8}$ in. diameter × $\frac{7}{16}$ in. stroke, feeding a centre-flue boiler driving an S.T. "Sun" engine, $\frac{3}{4}$ in. × $\frac{3}{4}$ in. stroke S.A. twin, which runs at times in the thousands of r.p.m. and has never given a moment's trouble.

I have made a good few models,

generally to designs published in THE MODEL ENGINEER, including the following:

1. Scarlet Runner in February, 1909.

2. Barton Mott's W.T. boiler, 1907.

3. 30 in. sailing yacht, by A. Noble, 1902, I think.

4. 5 ft. speed boat, by Mr. Matthews, 1912, I think, with the boiler and engine designed by J. Dysart in earlier issues.

Mr. Dysart's boiler is a splendid steamer and has a 3 in. diameter flue in a 4 in. diameter boiler.

5. Numerous fittings described by "L.B.S.C." which I have adapted for model ships.

Yours faithfully,
Edinburgh. Wm. M. ROBERTSON.

REPLY TO A CRITIC

DEAR SIR,—Your correspondent "Cheesehead" in the issue of 1st October, asked when the S.M.E.E. were going to build some new locomotives, implying that the only S.M.E.E. locomotives on show were two old veterans he had seen for "donkey's years."

As chairman of the S.M.E.E. Track Committee and organiser of the track display at the exhibition, I should like to bring a few facts to the notice of your readers. For the past two years the S.M.E.E. have invited and encouraged the London and Home Counties clubs to use the society's track during the exhibition to display and run their own engines. A number of clubs have responded to this invitation. One club, the Harlington Small Loco. Society, ran the track for a whole day with their own engines and personnel. Where was "Cheesehead" on that day?

As for the society's own engines, *sixteen* were on show, taking their turns on the track, not to mention the engines of visiting clubs, several of which were also on show. These engines, belonging to S.M.E.E. members, made a show of running to locomotives which included types ranging from engines of the last century up to the present day, and even one which might have been the engine of tomorrow. Indeed this engine, an articulated 2-6-6-4, was making its first public appearance on the track as a new engine.

Surely "Cheesehead" would not suggest that the S.M.E.E. should scrap the few older engines in favour of these more recently built, in spite of the fact that they are as useful, efficient, and attractive as ever.

Yours faithfully,
London, N.14. H. E. WHITE.

The late W. J. Bassett-Lowke

THE news of the death, on October 21st, of Wenman Joseph Bassett-Lowke, founder of the firm of Bassett-Lowke Ltd., must have come as a personal shock to model engineers, old and young, in every part of the world. He was 78.

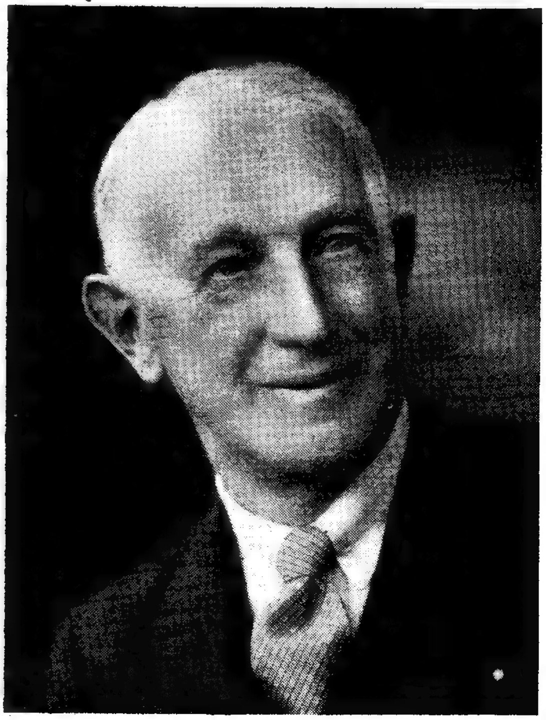
More than fifty years ago, Bassett-Lowke had pioneered the manufacture of castings and parts for the making of models which, as distinct from the mere toy, bore some resemblance, structurally and mechanically, to their prototypes. He established his business in his home town of Northampton, where he lived all his life and, for many years, took an active interest in local municipal affairs as a member of the local council and attaining the dignity of Mayor.

Bassett-Lowke, known to his intimate friends as "Whynne," was one of the friendliest of men and possessed an energy and enthusiasm which were such that few of the many ideas that formed in his active mind seldom failed to come to full fruition. Apart from his business and municipal activities, he was instrumental in founding a successful theatrical repertory company in Northampton; he was also a keen and expert photographer, in "still" and cinematograph fields.

In model-making, he was a shiplover first and a railway enthusiast second; but it was the model locomotive and its improvement which came uppermost in his mind when he started his business. In course of time, and as quickly as circumstances permitted, he catered for other branches of model making. Finally, the products of the Northampton factory became world famous.

As a lecturer, Bassett-Lowke was always entertaining and interesting, with a happy knack of capturing the imagination of his audiences. He broadcast on a number of occasions in recent years, and spared no pains to provide his listeners with something worth while. Ever ready to help forward the progress of our hobby, especially on the commercial side, he became the first Patron of the Model Engineering Trade Association, to which he gave encouragement and advice to aid in putting the association on a firm foundation during the initial stages of its existance.

About twelve months ago, his health began to show signs of breaking down; but he refused to give in and he continued his endeavours to apply his characteristic energy to the business he had so much at heart. His ability to inspire respect and stimulate enthusiasm endeared him to anybody associated with him. His death has removed a well-loved personality from our midst, but the results of the untiring efforts which, for some fifty-five years, he exerted in the cause of model making must remain, for a very long time, a fitting memorial, not only in Northampton, but in many other places the world over.



Some Reminiscences

By Frank L. Baines

(Editorial comment: Few of those of our readers who have visited the Science Museum, South Kensington, can have failed to see and admire the very fine 1½-in. scale Great Northern Railway Stirling 8-ft. single-wheeler locomotive built by Mr. Baines; it is in a case to itself, in the Land Transportation section of the museum and has no tender, yet it is unquestionably one of the most outstanding examples of its kind in the world. But we doubt if many people know anything at all of the inside history of this model; therefore, we have much pleasure in publishing the following letter recently received from Mr. Baines. At the same time, our thanks are due to the Science Museum authorities for the photograph reproduced.)

I HAVE been much interested in the accounts of the running of the two veteran G.N.R. Atlantic locomotives in the Doncaster centenary celebrations, and also in the activities of our local model railway clubs in connection therewith.

Although very far removed from the serious kind of model making which obtained in my early days, I can still take a certain amount of interest in the doings of the younger generation, and I must say that I am surprised and very gratified to find that the good old steam locomotive still takes pride of place in their affections. I should very much have liked to have seen these two veteran locomotives again, but being in my eighty-third year, and not enjoying very good health, I do not get about very much.

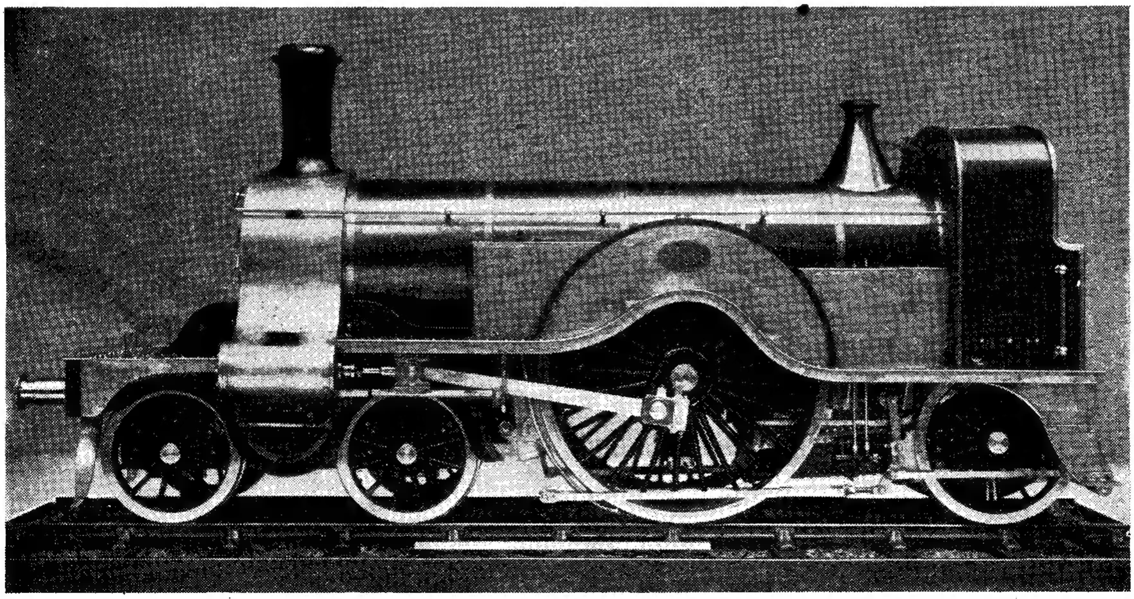
One of my pleasantest recollections of just over fifty years ago was an interview with the late H. A. Ivatt, who was then the new superintendent at the G.N.R. plant, and the designer of the *Henry Oakley* locomotive, and it happened in this way: When the model Stirling locomotive, now in the Science Museum at Kensington, was nearing completion, I was placed in a serious difficulty, owing to the death of the chief draughtsman who had supplied me with drawings and details by special permission of the late Patrick Stirling, Mr. Ivatt's predecessor. After a good deal of thought I decided to write to Mr. Ivatt and ask for an interview, and this he kindly granted; so one afternoon I went over to Doncaster taking the complete bogie and one or two details, including an outside connecting-rod with me.

After I was shown into Mr. Ivatt's office, I placed these items on the table so that he should see them as early as possible, and after greeting me he stood examining them in silence for a few minutes. He then rang the bell for a porter, who came and was told to fetch Mr. Martin, the then chief engineer.

When he came in they had a consultation, and then congratulating me upon " a fine piece of work " (their words), Mr. Ivatt said, " I am sending you in to the new chief draughtsman, and I am giving him instructions to let you have anything in reason to complete this fine model."

After this, of course, I came home rejoicing, and thought all my troubles were over, but there were still some trials and tribulations to come, and these would make quite a story, but I will be content with telling about the final stage by which it came to its present home. Being so far from London, it was found difficult if not impossible, to get anyone from the Board of Education (to whom I intended to offer the model) to come and inspect it, and so I decided it would have to be another case of " Mahomet and the mountain."

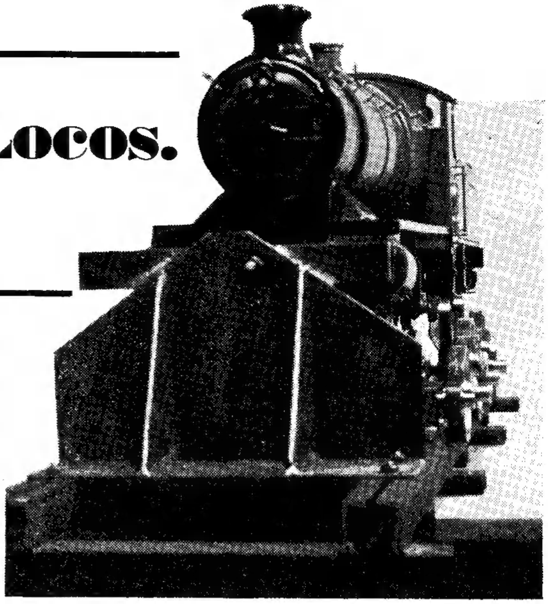
(Continued on page 587



Mr. F. L. Baines's 1½-in. scale G.N.R. single-wheeled locomotive.
Photo: Crown Copyright. From a model in the Science Museum, South Kensington

Testing Small Locos.

By A. W. Smith (Portugal)



Front view, showing engine bracket

HAVING recently finished my *Iris* 3½-in. gauge locomotive after nine years untold pleasure (not forgetting some of the untold language when things came out " wonky "), I decided that a testing stand would be of great interest, insofar as the engine could be watched from an arm chair so to speak, and it would be a change from my attic track of short length.

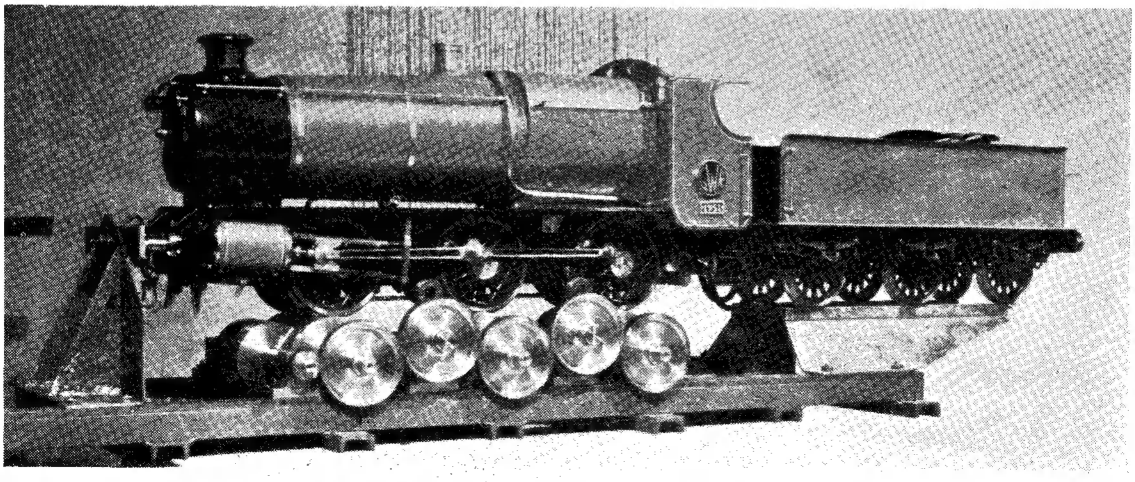
On looking up past numbers of " ours," I found an article on such a stand described by Mr. G. W. Wildy in Volume 103 page 439. This did not appeal to me, however, as I rather prefer a gear drive to a chain, but am not prepared to say whether one has any advantage over the other. The stand is certainly very versatile and, I am quite sure, does all its stuff; but as there is hardly sufficient detail in the article, I had to set to and design a stand myself rather than copy the one shown. So much the better and lots more fun.

For a start I decided that two pairs of channel-iron welded together to make the " rails " upon which the bearings could be set in any position, would be the first step, they in turn being welded to the backs of channels like sleepers on a railway. This would be the bed and, after being made, it has turned out to be fairly light but very strong.

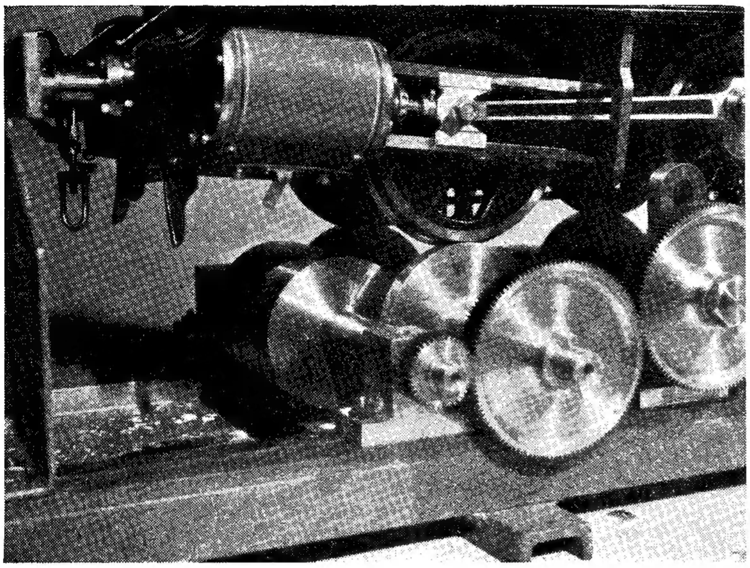
There are three main shafts for this particular engine, but there is no limit to the number that can be used. These shafts are carried in plain bronze bearings, and on each shaft there are two discs or rollers upon which the engine wheels run. One of the bearings can be easily seen in the photograph on page 587, as well as one of the discs with the driver resting on it. The roller ahead of this disc is just a solid piece geared up to give some momentum to the whole when under way.

All bearings are cast from a single pattern, as they are identical, the only difference being in the machining of the three bearings for the idler slides, as the holes for the pivot-pins are drilled at a lower level to allow the gears to take up as low a position as possible in order to gear up properly when wide centres obtain in the drivers. For closer-coupled engines these idler gears are moved upwards in the slide and locked in position, and the whole job lines up to a nicety. The discs on the gear side are press fitted to the shafts, their opposite members being a sliding fit and keyed. For 3½-in. gauge operation they are locked in position by screws in the bosses. For 5-in. gauge work they are simply opened out and rub against the opposite bearing face and, therefore, require no fixing.

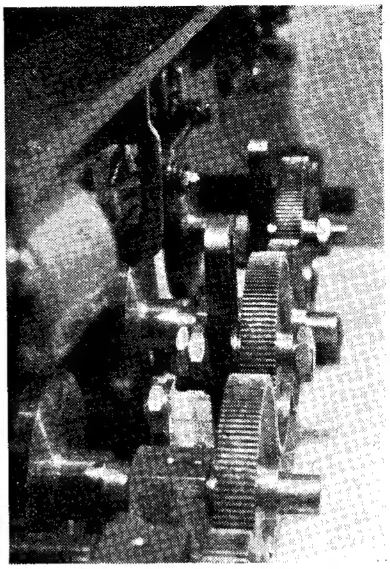
The bearings are fixed to the rails by ordinary carriage bolts which have



The testing stand and the supporting brackets for engine and tender



Showing the discs and bearings



Close-up of gear side

a square portion just under the head. This square runs in the groove formed by the two channels which are welded together with a space between them suitable for them to slide in. In my case, I was able to have the top surface and groove machined, which made a nice job and more easy to align, but this is not altogether necessary, as suitable packing can be used if desired. Tee-bolts would be a lot better than carriage bolts because assembly will then be facilitated, as any bearing can be removed without disturbing the others.

The gears were cut from the solid after the pattern of the old-time magneto telephone, and if any reader who is desirous of making this stand can buy, borrow, or otherwise annexe a set of these, they will do fine. The draw-bar bracket is just a few bits of $\frac{1}{8}$-in. plate welded together and needs no explanation, but any other kind of bracket will do just as well so long as it can hold the engine in position safely. The tender is supported on two pieces of similar plate bent to shape and bolted to the rails in the required position. Both brackets can be seen well in one of the photographs.

The engine is held by its own draw hook and pulled tight against the buffers which bear on a cross bar welded on to the bracket. The stand is long enough to fit a dynamometer or any other device for measuring the power if desired. I have not got to this stage yet, being quite content to just watch things going round. It is very fascinating to do this and a lot of fun can be had without chasing the engine all over the place. Particularly, can one observe any one point more attentively, there being no danger of the engine coming to grief on curves and so forth, as it isn't going anywhere!

For engines with leading and trailing trucks, similar plates as the ones under the tender can be used to support them if desired. There is no need for these wheels to go round at all unless for effect only, or in the case of a steam test, as they form quite a large portion of the friction which the engine has to overcome when doing its stuff.

As incidentals, I made two small zinc trays to fit between the rails to catch any drips and prevent spoiling anything underneath. They can be moved about in any position, as they rest on the cross bearers of the stand.

SOME REMINISCENCES

(*Continued from page* 585)

I, therefore, wrote to one of the leading motor firms with whom my firm did business, and obtained permission to exhibit the model in their window on Holborn Viaduct, and upon receiving a favourable reply I took the model over to Doncaster, and it was shown in Messrs. W. E. Clack's motor showroom window for a few days to enable the plant people to see it.

Upon receiving instructions from London I went again to pack up the model, and took it by one of the newly inaugurated non-stop trains to Kings Cross at 3 p.m., which arrived at London 6 p.m. As a slight concidence, Mr. Stirling's son travelled by the same train, and he watched the model being put in the van as traveller's excess luggage.

After setting up the model on Holborn Viaduct, I returned home; but after a few days I had a letter asking if I would go again and place it on the firm's stand at the Motor Show which was on at Olympia. This I did, but after it had been there three days they wrote again to ask me to remove it, as it was diverting too much attention from their exhibits!

It was now no trouble at all to get the Board of Education to consent to a loan of the model for a time, pending the purchase of same if thought desirable, and this was brought to a satisfactory conclusion at the end of 1905.

It is, of course, some little satisfaction, and perhaps a little modest pride to me after all the ups and downs attending the building of this model, to know that it has given interest and pleasure to many thousands of young and old who have visited the museum.

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Lathe for Wood and Metal

I require a lathe for general purpose model making in metal and wood—preferably with a milling attachment—that could also be used for wood bowl turning.

I have a fairly large number of felled fruit trees of various kinds up to approximately 2 ft. in diameter. The h.p. required to drive a lathe to convert these into bowls would I presume be fairly high as compared with that required for ordinary model making?

E.F.T. (Hook Norton).

Many amateurs use small screw-cutting lathes to cover both classes of work, but when more serious wood-work is undertaken the types of lathe required are to a great extent incompatible.

Woodwork can be carried out on a very simple, or even primitive type of lathe, but it must run at a fairly high speed and will require a considerable amount of power to drive.

In your particular case, where you wish to deal with work up to approximately 2 ft. in diameter, we should strongly advise obtaining a separate lathe of a rugged and simple type. A metal-working lathe to cope with work up to this size, even allowing for the fact that it could be mounted on the outer end of the mandrel, would be very expensive.

Screw Threads

What are the guiding principles in the choice of screw threads? That is, when should Whitworth, B.S.F. or B.A. be used, assuming that there is a choice in the size required?

J. McL. (Blackburn).

The coarser threads are tending to become obsolete in modern engineering practice, in favour of rather finer threads which give a much stronger bolt or screw, as they enable the core diameter of a given size of screw to be increased. If, however, the strength of the thread itself is the more important, a coarser thread is to be preferred.

Under the older conditions of manufacturing, when screw-cutting equipment was relatively inaccurate, coarser threads often gave better results.

In the case of B.A. threads, the particular thread form is designed to give the best possible compromise between strength of the thread itself, and that of the bolt or screw, and this thread is generally much to be preferred for small size bolts and nuts, particularly in view of the fact that there is a fairly wide range of sizes in this thread standard.

Plastic Knobs

Can you please furnish me with details of any retail suppliers of spherical ebonite or plastic knobs of the type commonly used for capping levers on machine tools, etc.? Failing this, do you know of any manufacturers of same?

D.O. (Greenford).

Ebonite or plastic knobs are made by the following firms: Bluemel Bros. Ltd., Walston, nr. Coventry, or Ebonestos Industries Ltd., Excelsior Works, Rollins Street, S.E.15.

We do not know of any firm handling retail supplies of these articles.

Jet Motors

I understand that some articles have been published in THE MODEL ENGINEER *on the construction of model jet motors. Can you please inform me of the dates on which these articles appeared? Also, can you give me any further information available?*

C.F.N.P. (B.A.O.R.).

Articles on the subject of jet motors appeared in the issues dated August 14th and 21st, 1947 and February 19th, 1948.

We regret that we have no further information than that contained in these articles. This is a subject on which we have to proceed with considerable caution, as motors of this type have been banned by several model organisations owing to noise and danger in running them.

Capacitor-start Motor

I have a $\frac{1}{16}$ h.p. mains voltage capacitor-start induction motor which requires a new capacitor of 2 M.F. 375 volts. Could you tell me where I might purchase same and is the above description sufficient for a dealer to understand my wants?

W.L. (London S.W.5).

The capacitor, which is another term for condenser, should be obtainable from any firm dealing with electrical and radio apparatus, and the specification should be sufficient to enable the correct value condenser to be supplied.

It is, however, important to note that the insulation of the condenser should be sufficiently good to enable it to work continuously at the rated voltage.

Refrigerator Conversion

I have a two-cylinder Frigidaire compressor of the type supplied second-hand by one of youra dvertisers, which is charged with SO_2 and is giving very satisfactory service.

I should like to change the refrigerant, mainly because of the unpleasant results of leaks and the possibility of corrosion in certain circumstances.

Can you advise me if both Methyl Chloride and Freon will work satisfactorily in this compressor, which has a $\frac{1}{4}$ h.p. R.1. motor and is stepped down to run at lower speed than normal in view of the surplus compressor capacity available. If either can be used, which of the two will be more efficient, and will they both be more efficient than SO_2?

G.V.S. (West Humble).

There are several practical difficulties in such a conversion, in view of the fact that the specific gravity of these refrigerants, and also their working pressures in a refrigerating system, are different from that of sulphur dioxide. In these circumstances, the various components of the system, including the expansion valve, thermostat, and the amount of heat transfer surface in the condenser and evaporator may not be suitable.

You will no doubt appreciate the fact that compressors designed to work with a particular refrigerant have to have all these components very carefully balanced.

It is quite possible that a conversion of this nature may be successful, but on the other hand there are a number of potential causes of trouble which might be difficult to deal with. Another practical difficulty is the complete removal of SO_2 from the system, as any residue might be liable to cause trouble sooner or later.